IONEER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY

# The Welding Engineer

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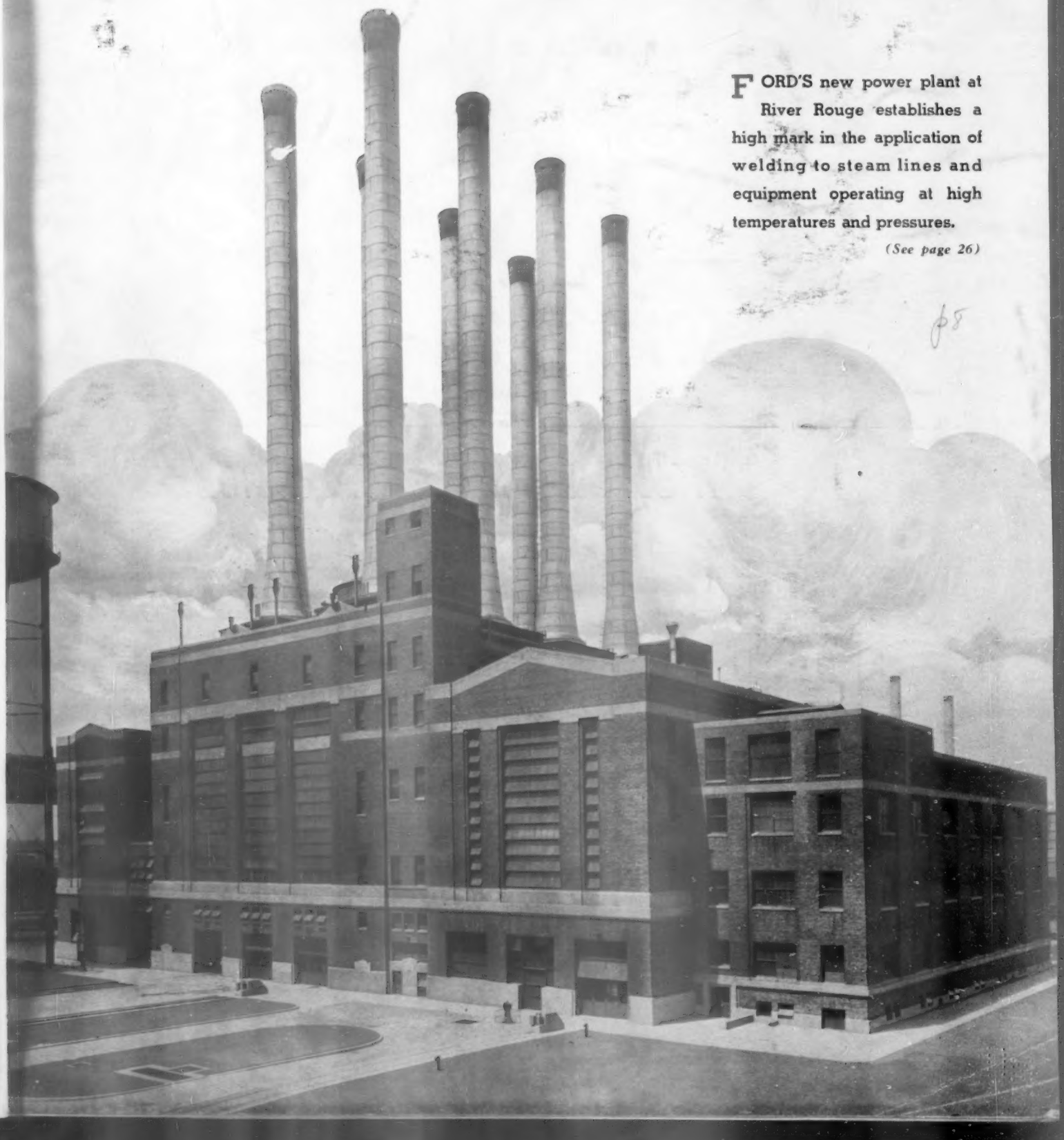
Volume XXII January, 1937 Number 1



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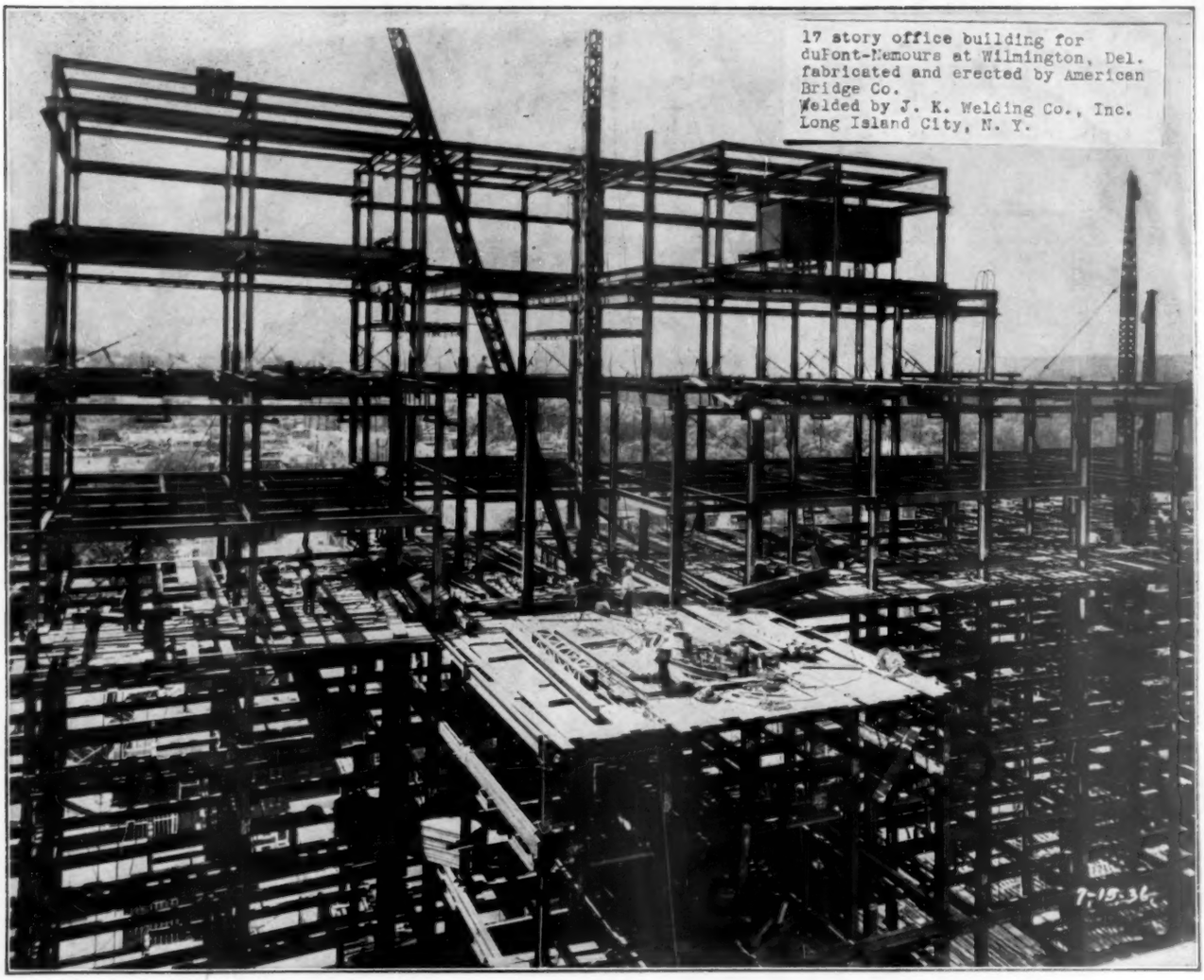
*(See page 26)*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# THE WELDING ENGINEER

Vol. 22, No. 1 JANUARY, 1937

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The Welding Engineer

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# Lining Tanks With Stainless-Clad Steel . . . .

By W. B. KEELOR
Engineer, Ingersoll Steel & Disc Division,
Borg-Warner Corporation

IN RECENT years a substantial tonnage of stainless-clad steel has been used for the lining of tanks, vats, and soap kettles. This type of lining has been most widely used in the soap industry to give a corrosion-resistant coating to the walls of new and old soap kettles. There have also been applications of stainless-clad-steel linings in the food and other process industries. Many linings have been in service for several years, proving the method and application to be entirely satisfactory.

A procedure has been developed for installing these linings so that the stainless-steel surface is continuous and unbroken. This procedure is exceptionally low in cost and affords complete protection from corrosion at those areas of the tank or kettle requiring such protection. With this method, it is possible to line the entire vessel, or only a portion of it (such as the upper courses), all depending upon the areas affected by corrosive attack. One of the leading soap manufacturers chooses to line the entire walls of his soap kettles, but not the bottom, whereas another manufacturer lines only the upper portion of the kettles, to avoid corrosion above and at the liquid-level line.

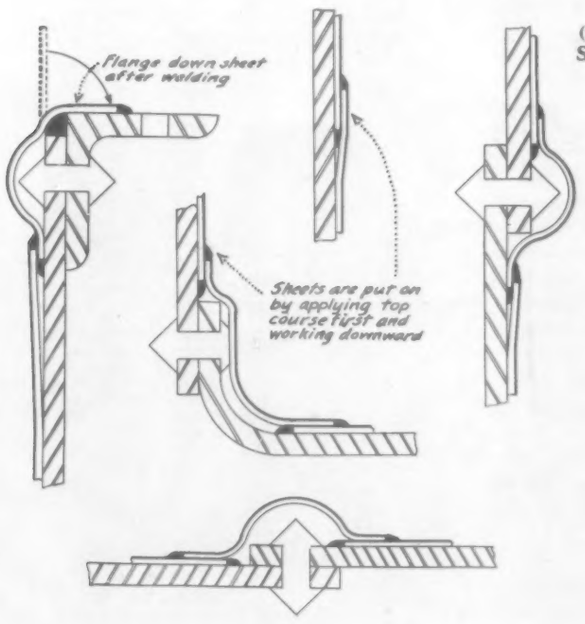
In almost every instance stainless-clad steel of 16 gauge has been used for these linings, in which the steel sheet has on one side a layer of 18-8 stainless, comprising 20% of the total sheet thickness.

This stainless layer is inseparably welded to a foundation layer of ordinary steel by the "cast-in-the-ingot" process. Since the clad steel costs only about one-half as much as solid 18-8 stainless steel, it is an economical material for kettle and tank linings.

In laying out sheet sizes for a lining, it is well to confine the sheets to one size insofar as possible, as this will result in maximum economy in purchasing the stainless-clad steel. The more individual sizes, the greater will be the cost.

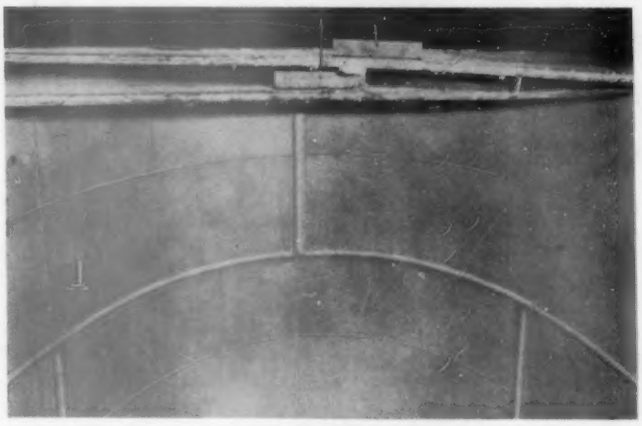
To overcome fit-up difficulties, lap welds are used throughout, as indicated in the accompanying drawings. A 1-in. lap is suggested.

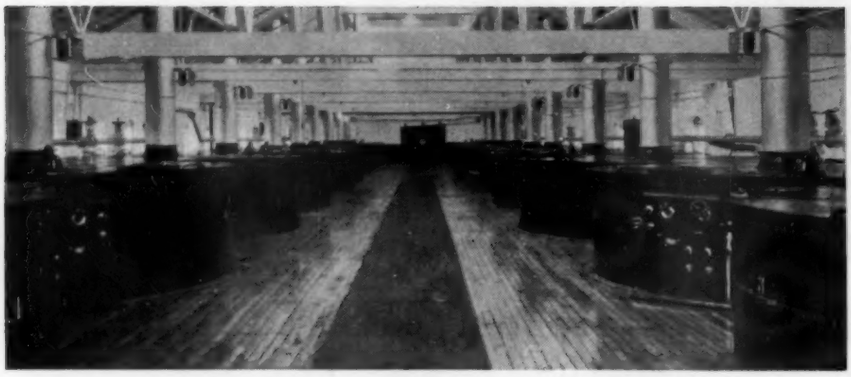
Butt-welded tank construction can be stainless-clad lined using lap welding




(Left) Details Showing How Stainless-Clad Sheets Are Applied to Interior of Steel Tanks.

(Below) Interior View of Riveted Tank With Stainless-Steel Sheets Applied by Welding. Note the Raised Strips Over the Rivet Rows.





**All These Soap Kettles Are Lined With 16-Gauge Stainless-Steel Sheets, and the Stacks Are of the Same Material.**

throughout. For lining riveted structures it is advisable to attach formed strips over the riveted seams to avoid a gap between the lining and the wall of the structure. The drawings show details of this design.

Stainless-clad sheets of the thicknesses used can be pushed into place manually, so it is not necessary to roll them to the radius of the cylindrical vessel.

Flanging over angles at the top of open tanks can be done after the top sheets are in position.

As the sheets are placed in position, they are tack welded to the wall of the vessel. First, they should be attached around the top of the tank, and then each succeeding course below applied working downward. This procedure makes the most desirable welding conditions.

Metallic-arc welding must be used. Motor-generator welders of 50 to 300 ampere capacity have proved very satisfactory. All welds not exposed to corrosive media may be made with shielded-arc mild-steel electrodes, preferably of ⅛ in. diameter. Exposed welds subject to corrosion in the vessel should be made with 3/32-in.-diameter coated electrodes of 18%-chromium 8%-nickel, or higher analysis. About 300 lineal in. of weld may be expected from a pound of a good 3/32-in. rod of this analysis. For stainless welds, the current must be high enough to give good arc characteristics, but not so high as to cause overheating of the welding rod.

Vertical welds are easily made, provided proper amperage is used and a short arc is maintained. If the walls of an old structure are severely rusted, it is desirable to grind or chip the rust away where the welds are to be applied.

Lined structures should be free of grease, dirt, scale, oxides and other foreign matter to assure best results. Oxides and discoloration in the weld area may be removed by pickling with an acid solution, but in many cases conditions do not demand pickling after installing the lining.

The cost of a stainless-clad-steel lining depends mainly upon the cost of the material and the cost of labor. Stainless-clad steel costs from 45 to 55 cents per sq. ft. in 16-gauge thickness, depending upon the quantity of sheets required. Labor costs vary considerably with the design of the structure being lined, as well as local labor conditions. Figures taken from a recent kettle-lining installation may serve as a guide for other similar jobs.

In placing a stainless-steel lining in a soap kettle of riveted construction, 12 ft. in diameter and 10 ft. deep, 100 man-hours were required. This included time and labor to move the material to the job, erect the scaffold, form the sheets and strips over the rivets, weld, clean, etc.

This represents an attractively low cost to reclaim a tank that had been rendered useless by excessive corrosion. Likewise, this is an economical way to convert an ordinary steel tank into one that offers stainless-steel protection at the areas subject to attack, with all the attendant advantages of sanitation, and of freedom from rust and contamination to the product.

This general procedure is extremely flexible and may be applied to old or new tanks, kettles, vats or hoppers, regardless of whether they are cylindrical or rectangular in shape.

## Welded Tubular Framework for Light-Weight Coach

A framework consisting of square tubes with all joints welded, is one of the unusual constructional features of a new type of coach conceived by Wm. B. Stout, noted aeronautical engineer, and described by Stanley E. Knauss, manager of the motor coach division of Gar Wood Industries, Inc., before the annual meeting of the Society of Automotive Engineers, held in Detroit, Jan. 13.

Light weight is obtained by employing aircraft materials, and passenger comfort is enhanced by placing the engine in the rear and using a special type of spring. For the most part, 1¼-in. square welded tubing is used in the framework, and a small amount of round tubing is used at the front and rear ends where double curves appear, to facilitate the installation of the outside metal covering. The coach has no chassis. All frame joints are welded, there being no screws, rivets, bolts, wood or any other metal in the entire structural assembly. The outside metal covering, of 22-gauge body steel, is installed with self-threading screws to simplify replacements of damaged panels.

The frame unit complete weighs approximately 745 lb. without doors, and the steel and aluminum covering another 750 lb. Also, 750 lb. is required for the plywood floor, linoleum, inside walls, head lining, moulding and insulation material. The completed coach weighs less than 6,500 lb.

The advantages of light-weight construction are many. In the first place, it reduces gasoline consumption. Also, it is possible to use the smaller mass-production power plants, axles, transmissions and clutches—and parts are available in practically every city. Smaller tires can be used, and this reduces tire cost and brings the coach closer to the ground.

With the interior fitted for a transit type of service, this coach will accommodate 24 seated passengers and a standing load of 24 more.

Two accidents already experienced on the road with these new coaches indicated that the welded tubular structure absorbs and localizes shocks to a high degree.

## Arc-Welding Foundation to Promote Scientific Work

The forming of The James F. Lincoln Arc Welding Foundation has been announced by The Lincoln Electric Co., Cleveland, O., to stimulate scientific development in the arc-welding field, and to honor the pioneer work of the company's president in promoting arc welding and perfecting and developing arc-welding equipment and electrodes.

Objects of the Foundation, and the significance of its name, are set forth

**J. F. Lincoln, Honored by Creation of Foundation Bearing His Name.**

in the inaugurating resolution just adopted by The Lincoln Electric Company's board. This states in part:

"Whereas, it is desired in the public interest that careful and extensive scientific study, research and education in respect of development of the arc welding industry be encouraged; and

"Whereas, the comparatively recent developments of electric arc welding disclose a vast field of study and research which yet is in its infancy . . .; and

"Whereas, through such study and research, the public and modern industry should have the benefit of accurate knowledge and information in matters affecting the application of electric arc welding to machinery and equipment; and

"Whereas, it is the desire of this Company to assist in furthering said objects and to provide suitable rewards therefore;

"Now, therefore, be it resolved that The Lincoln Electric Company should, and it does hereby, found, create and establish for such purpose, a scientific educational Fund and Foundation, which shall be organized and operated exclusively for the purposes as set forth in this resolution; and further, as a token of its esteem and respect for James F. Lincoln, and for his wide experience and interests in said scientific subjects, it denominates such as 'The James F. Lincoln Arc Welding Foundation.'"

Principal direction of the Foundation's work will be given by Dr. E. E. Dreese, Chairman of the Department of Electrical Engineering of The Ohio State University. Other trustees who will serve with Dr. Dreese on the Foundation are W. B. Stewart, distinguished member of the Cleveland bar, and H. R. Harris, vice-president of the Central United Bank of Cleveland.

It is expected that the directors of the Foundation will complete their organization of a comprehensive program at an early date, and that the Foundation will shortly announce the first of its activities.

It is intended that the activities of the Foundation shall not conflict with research or promotion now carried on by other groups interested in arc welding, and the Lincoln company states that the Foundation will have no relation to the commercial activities of their firm or any other in the arc-welding field.

## All-Welded Hospital for New York City

The first all-welded building of any substantial size erected within the limits of New York City, is now undergoing construction in the borough of Brooklyn. The structure is a 6-story New York State hospital building, located in the Flatbush section of Brooklyn, next to the Kings County hospital; it is designed for later extension to eight or nine stories. Approximately 600 tons of steel will be used in its construction. Completion is expected in the early fall.

The structure is being built from plans of Commissioner of Architecture William E. Haugaard, of the N. Y. State Department of Public Works, by the Caye Construction Co., Brooklyn. Structural steel is being furnished by the Ingalls Iron Works, Birmingham, Ala. Gilbert D. Fish, of New York City, is the consulting engineer on welded construction.

## 521-Ft. Tanker Will Be World's Largest Welded Ship

A tanker being built for The Atlantic Refining Co. in the Chester, Pa., shipyard of the Sun Shipbuilding Co., will be the world's largest welded ship. With a dead-weight tonnage of 18,500 tons, this new oil carrier will also be the largest commercial vessel under construction in American shipyards.

The new tanker will have a length of 521 ft. between perpendiculars, a beam of 70 ft. and a cargo capacity of 156,000 bulk barrels of gasoline. Turbo-electric engines developing 5,000 hp. will give the vessel a speed of more than 13 knots, enabling it to make the trip between Philadelphia and Texas gulf ports in the unusually fast time of six days. It will carry a crew of 8 officers and 26 men.

Preliminary construction work has already been started and the vessel is scheduled for delivery to The Atlantic Refining Co. by the end of the year.

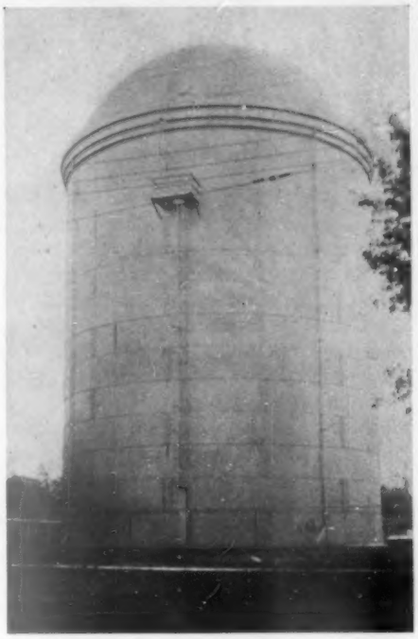
## Phillips Petroleum Co. to Build 100 Welded Tank Cars

The interstate commerce commission has granted the application of the Phillips Petroleum Co. for building 100 fusion-welded tank cars for transporting liquefied petroleum gases. This program grew out of an application that Phillips made on the ground that demand for and use of liquefied petroleum gases have increased beyond all expectation.

A short time ago, the Commission granted Phillips permission to build 25 fusion-welded cars for experimental work in such service, and these cars are said to be in constant use. The 100 new cars are to conform to I. C. C. Specification 105-A-300, except for the fusion-welding feature. Owners or operators of the cars are to make semi-annual inspection and report on the results.

## Large Water-Supply Tank Has Welded Dome

A water-supply tank, 65 ft. in diameter and 81 ft. high, was recently completed for the city of Dunkirk, N. Y., for use in connection with the city's municipal water-supply system. Although the shell of the tank is riveted, the roof or dome is lap welded. The tank was fabricated at the Leetsdale works of the Bethlehem Steel Corp., in the Pittsburgh district, and shipped knocked-down to Dunkirk for erection. Three hundred and twelve tons of plates was used, and four months was required to complete the job.



**A Welded Dome Caps This Tank.**

An interesting feature is a revolving ladder which moves around the periphery of the dome, making it easily accessible to workmen for inspection and painting.

## Ohio Conference to Be Held in March

On March 3 to 5 will be held the sixth annual welding conference by The Ohio State University at Columbus. A welding school will be held in connection with the conference, and school sessions will be held on each of the three days, according to O. D. Rickly, assistant professor of industrial engineering, who has charge of the program. The date of the conference at the University of Kansas, at Lawrence, is March 18 and 19, and Iowa State Conference at Ames will hold their annual conference on March 24 to 26.

## Welding to Be Discussed in Radio Talk

The wonders of welding will be unfolded in a scheduled "Ironmaster" talk by Bennett Chapple, vice-president of The American Rolling Mill Co., Middletown, O., over the NBC Blue network on Tuesday, Jan. 26, at 10 p. m. E. S. T. This is the usual Armco-band radio broadcast, and the talk will be of a non-commercial nature.

# Weld Designs: *Good* and *Bad* ▪ ▪ ▪

By **BELA RONAY**
Senior Welding Engineer, U. S. Naval Engineering Experiment Station, Baltimore

**EXPERIMENTS are described by which anyone can prove the need for proper spacing between the plates at the root of the weld when using the metallic-arc process.**

MAKING good welds consistently is not a matter of chance or luck, nor is it possible for the best welder to produce good welds on all jobs he may be assigned to do. Given the best of equipment and welding materials, ideal working conditions and a competent welder, the soundness of the weld also depends on another factor, weld design—which is much neglected and under-estimated. The term "weld design" is used here to mean the shape and proportions of the welding groove—or, more generally, the space to be filled in with weld metal to form the joint.

In Fig 1 are shown the two most notorious weld designs. These should be avoided in fusion-welded construction. The average welder—and many designers—will at once take issue with the author on this point. However, the author, though admittedly a swivel-chair welder, has pretty good reasons to strenuously discourage the use of weld designs such as these.

The difference of opinion between the practical welder and the designer on the one hand, and the test engineer on the other, calls for some plausible explanation. This paper undertakes to give the explanation in the hope that it will arouse the curiosity of some and that they will perform the simple tests suggested and thereafter will be in position to recognize poor weld designs and protest against their use.

Let it be assumed that the plate stock for use in our first experiment is machined and assembled as shown at "A" in Fig. 1. Let it be further assumed that the available welding equipment is good and the ability of the operator is above the average. It is suggested that the electrode be a high-grade brand of the organic shielded-arc type suitable for use with reversed polarity. The assembly shall be set up on a welding bench in such manner that the electrodes may be deposited working from left to right or vice versa, but not in the usual manner (that is, toward the welder).

## Bifurcated Arc Is Seen by Observer

In case it is decided that the welding shall progress from left to right, then let the observer take up his position at the other end of the bench, that is, on the right-hand side of the welder. The observer is to sit or squat so that his eyes are on a level with the groove to be filled with weld metal, so that as the welding progresses the electrode will travel toward him. As soon as welding starts, a phenomenon will be revealed to the observer which the welder cannot see, nor could he if he were posted at his customary position and posture. The observer will see a bifurcated arc such as is shown enlarged but not exaggerated in Fig. 2.

The explanation of this phenomenon is simple enough. The sketch at "A" in Fig. 3 shows the position of the electrode at the instant contact is established with the work. At "B" the appearance of the weak arc is shown at the instant of its formation.

Fig. 2 shows the fully developed arc in course of the deposition in the root of the groove.

A glance at Fig. 3 (B) shows that the shortest distance, therefore the least resistance, between the electrode and the work is not that between the electrode and the root of the groove, but the two normals between the electrode and the sides of the groove. As the deposition progresses, the arc remains bifurcated, since the target or targets continue to be along the sides of the kerfs, provided the current dwell is not increased by oscillating or weaving the electrode, which of course would result in melting through the root.

The metal transferred from electrode to work is hurled through the arc path and is thrown against the sides heated by the arc stream, which is always a trifle ahead of the deposit. This tendency of the arc to travel along the initially established path is known as the hot-cathode phenomenon, which is so much of a detriment since, under circumstances, it is an advantage to work with reversed polarity.

Let the above experiment be repeated by setting up another assembly in exactly the same manner as before but using a covered electrode suitable for deposition at straight polarity. Again the bifuraction will be noted on striking

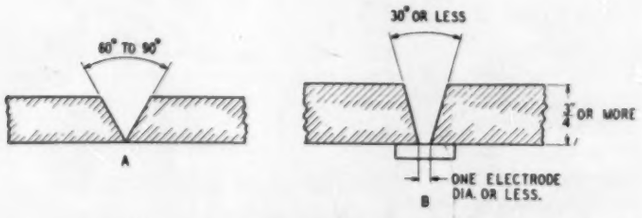



**Fig. 1. Two Examples of Notorious Weld Designs.**
(The spacing at the root of the weld should not be less than 1½ times the diameter of the electrode used at the root.)

**Fig. 2. The Bifurcated Arc Does Not Fill the Root of the Weld.**

**Fig. 3. At Left, Contact Has Just Been Established With the Electrode, and at Right, the Weak Arc Has Just Formed.**

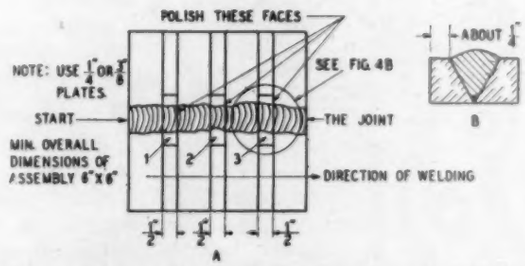



**Fig. 4. How to Prepare Weld Specimens for Etching.**

the arc; but as the work picks up heat, the bifurcation lessens and soon the arc assumes the normal spherical shape.

Since straight polarity is used this time, the electrode is the hot cathode and therefore the arc is maintained not, as before, between the base metal and the electrode, but between the electrode and the last deposit, which is now the hottest part of the assembly.

Deposition with straight polarity eliminates the bifurcated arc, but it does not necessarily fill the root any better than when reversed polarity is used. With straight polarity, the weld metal is hotter than in the case of reversed polarity and therefore it is more fluid. On the other hand, the base metal is not preheated directly by the arc, as in reversed-polarity work, hence the higher fluidity of the fresh deposit is counteracted and the degree of penetration into the root zone attained with straight-polarity deposition is no better than that resulting from reversed-polarity deposition.

### Weld Roots May Be Examined by Polishing and Etching

To determine the extent, or lack, of fusion at the root of the test welds produced, the etch test is recommended. The fracture test is the quickest, but is not always fully informative because the edges may be damaged and thus the proof may be obliterated. The method to secure representative specimens from the three regions of the seam is shown in Fig. 4.

Cut out a minimum of three sections as indicated, numbering them in rotation, giving the lowest number to that representing the starting or cold end of the joint. Trim the transverse sections to the proportions shown on sketch "A" of Fig. 4. File one face of each section with a smooth file until all the scratches disappear, and then with No. 000 emery paper, polish until the faces are smooth and shiny.

The specimens should be etched one at a time in order to prevent staining. A 5% solution of nitric or hydrochloric acid applied hot is a suitable reagent to develop sharp contours between the weld and base metals.

If it is desired to see the macrostructure of the section, the use of ammonium persulphate is indicated. This reagent, used as a full strength or saturated solution, will show the contours of the weld plainly and, in addition, the difference between the macrostructure of the weld metal and that of the base metal. If the weld metal is built up in several layers, each pass may be identified and the nature of the grain structure of each pass revealed.

The moral: In order to obtain satisfactory fusion between base metal and weld metal or between existing weld metal and the superimposed first deposit, it is an absolute requirement that the contour of the entire surface which is to be covered with weld metal be such that all of it shall be accessible to the direct heat of the arc during deposition.

The parting shot: (a) Let the root spacing be, whenever possible, not less than 1½ times the nominal diameter of the electrode intended for use at the root.

(b) When the use of a backing strip is indicated, do not hesitate to use it, even though its removal and the subsequent chipping out and rewelding of the first layer of weld metal, may actually cost a few dollars—a mere trifle for the additional safety obtained.

(c) When code requirements prohibit the use of a backing strip, suggest a weld design that will permit fusion at the root of the weld, and insist on such design, since the additional machining cost seldom if ever is prohibitive for the execution of common-sense designs.

## Welding of Abrasion-Resisting Plates

By EDWARD J. BRADY
Joseph T. Ryerson & Son, Inc.

Abrasion-resisting plates have a wide range of application such as scraper blades, grain- and feed-mill liners and spouts, concrete mixers, conveyors, hammer mills, dredge and sluice pipe, dragline equipment, coal and gravel screen and chutes, and machinery for handling sand, gravel, cement, and clay. Tests indicate that this material will outlast ordinary steel many times, and in certain cases it has proved better than the expensive high-manganese castings. It should be made clear that the measure of abrasion, as well as the measure of corrosion, is very definite and can be determined only by actual trial.

Because this material is low in price it can be economically and advantageously used in many cases where ordinary high-carbon sheets and plates have heretofore been adopted.

Abrasion-resisting plates are made in two grades—namely, hard and soft. A 3/16-in.-thick plate will have a Brinell range of 247 to 262 for the hard grade, and a Brinell range of 232 to 236 for the soft grade. On heavier plates the Brinell hardness will be lower, and on thinner plates it will be higher. Both grades come as rolled—that is, not annealed or normalized.

In the welding of this steel, it is extremely undesirable to obtain a pick-up from the parent metal. In fact, absorption or dilution with the parent metal will cause extreme embrittlement of the weld deposit, resulting in cracking.

Here it becomes necessary to use an electrode possessing the least possible penetration with the maximum amount of ductility. A straight-polarity shielded-arc electrode is recommended, since it has approximately one-half the penetration of a reversed-polarity electrode. We further find that if the straight-polarity electrode is operated on reversed polarity, we have still less penetration. Therefore, it is recommended that a straight-polarity electrode be used on reversed polarity. For plate thicknesses heavier than 3/16 in., use a 5/32-in.-diameter electrode, and for 3/16-in. plates and under use a ⅛-in.-diameter rod.

A soft, ductile weld joint in abrasion-resisting plates presents another problem. If the weld joint comes in a position where it is subjected to maximum wear, it is very probable that the weld will wear down long before the surrounding plate. In cases of this type, it is recommended that a stainless-steel electrode of the 18-8 type be used. The wearing properties of this weld deposit will be greater than the parent metal, and a pick-up of alloys from the plate will not appreciably affect the ductility of the weld metal. The same diameter of electrode should be used as in the case of the mild-steel electrode.

Another difficulty that arises in the welding of this steel is the fact that if the plates are held in a rigid position and have little chance of contracting after the welding operation, a stress will be set up sufficient to cause hair-line cracks running at right angles to the weld seam. This can be eliminated if the entire plate, or a strip 2 or 3 in. wide adjacent to the seam, is preheated to a fairly high temperature. A dull-red heat is most satisfactory, but it will be found that temperatures lower than this will eliminate the cracks in most cases.

## New Welding Engineering Service for Industry

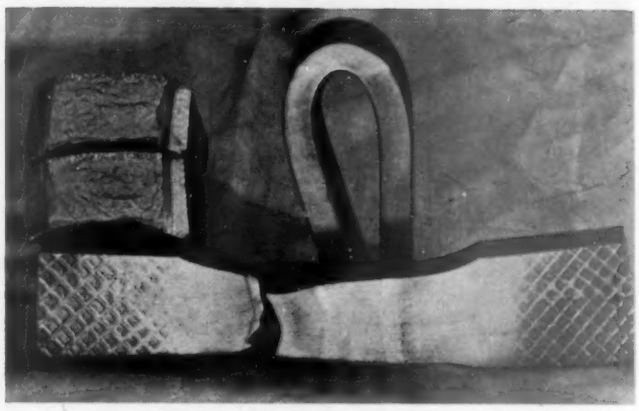
The organization of a new welding engineering service by the General Electric Co. makes available to industry in the Cleveland, O., area the services of a group of highly trained welding engineers. Members of this organization will be located in the offices of the company in Cleveland, Columbus, and Cincinnati under the supervision of H. O. Westendarp, Jr., who has been General Electric welding specialist for several years, and will offer assistance in working out problems involving the proper application of the various welding processes, the redesigning of parts to be fabricated, and the selection of welding equipment and electrodes.

Mr. Westendarp will be located at 4966 Woodland Ave., Cleveland, and will have two other welding engineers with him to cover northern Ohio and the territory surrounding Erie, Pa. The Columbus representative, who will be located at 40 S. Third St., will serve the central part of the state. Southern Ohio and the state of Kentucky will be covered by two engineers with headquarters at 215 W. Third St., Cincinnati.

Procedure for Assuring

# High-Quality Pipe Welds *in* Ford's New Power Plant . . .

PRIOR to the building of the new 1400-lb., 900° F. boiler in the No. 1 power house at its River Rouge plant, the Ford Motor Co. had the good fortune of having behind them many years of experience in welding joints by the metallic-arc process. Drawing upon this experience, they set up rigid qualification tests for determining the welding operator's ability to make sound welds.



**Nick-Break, Free-Bend-Test and Tensile-Test Coupons That Passed the Minimum Requirements for Qualifying the Welding Operator.**

## Welded Joint Has Many Advantages for Steam Lines

The advancements made in the art of welding and the developments in shielded-arc electrodes have tended to inspire greater confidence in the welded joint. These improvements, coupled with the fact that welding offers neat-appearing piping, no possibility of leaky joints, the fact that changes and additions may be made readily and insulation easily applied, led the Ford Motor Co. to undertake the job of building what is believed to be the first high-temperature all-welded piping job to be made in a steam power station.

The pipe-welding procedure used by the Ford Motor Co. is based on the use of the direct-current metallic-arc process with coated electrodes. All welders were required to pass extensive qualification tests, and were allowed to work on the high-pressure lines only after demonstrating their skill on the actual welding materials. The results of these welds were carefully checked both physically and chemically in the testing laboratories. Although the welders taking these tests had served, as an average, 10 to 16 years at their trade, it took six months to qualify a total of 23 welders from the pick of the welders in the Ford plant.

## Investigates Factors Affecting Weld Performance

Other investigations were made, probably the most important being the determination of the most satisfactory form of bevel, proper clearance, composition and size of electrodes, desirable number of passes or beads, and the effect of various operations such as cleaning and chipping, peening and stress-relieving. Such investigations were made with the purpose of producing a butt weld sufficient in itself and not requiring the use of supporting devices or reinforcing straps or saddles.

In view of the importance of qualification tests, a great amount of attention was given to devising a suitable procedure. In testing the welding operators on the Ford power-plant job, the following procedure was used:

First, a pipe-to-casting down roll weld with pipe rotating. This is defined as a joint made by welding from 30° above horizontal to the top center and moving the pipe to obtain a complete circumferential weld, so that the welding is always done from this position in relation to the top center.

Second, a pipe-to-pipe weld in a fixed position, with the pipe axis horizontal. Without turning the pipe, the welder makes flat, vertical and overhead welds to complete one circumferential pass, starting at the bottom and welding up to the top.

Third, a weld similar to the second, except that the pipe axis is vertical.

## Welders Qualified on Carbon-Moly Material

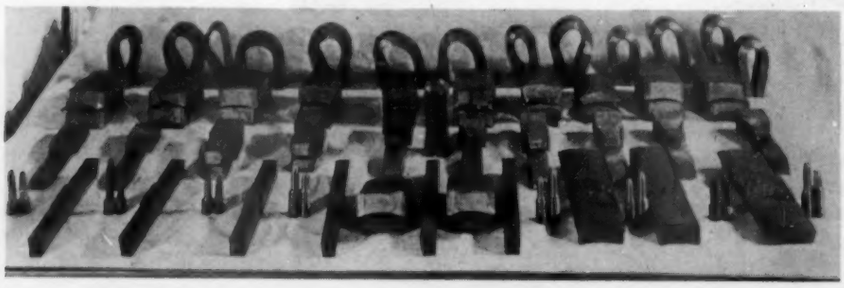
The above test welds were all made on a carbon-steel casting containing 0.50% molybdenum and on seamless tubing of similar composition. All welds had to be completely finished by the welder.

The test samples were then taken to the laboratories, where two tensile, two free-bend, and two back-bend coupons were taken from each weld specimen. The test requirements were as follows:

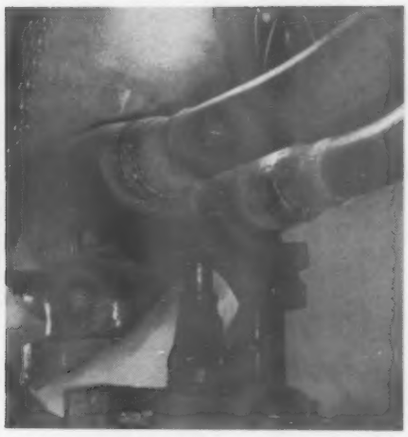
First, the tensile test shall not be lower than 95% of base-stock strength. The nick break test shall show in the fractured surface complete penetration through the entire thickness of weld, absence of oxide or slag inclusions, and no porosity.

Second, the free-bend test shall show not less than 20% elongation without cracking (cracks less than 1/16 in. long excluded).

Third, the back bend, which differs



**Coupons Taken From Pipe Welds and Tested in the Laboratory to Qualify Welders for Class-1 Pressure-Vessel Work.**



**Typical Position Welds of Pipe to Valve (Carbon-Molybdenum Steel).**

from the free-bend test in that the bend is in the opposite direction, shall give similar results. The failure of a welder to pass any one of these tests immediately disqualified him from welding in power-house work.

### Chill Rings Employed of Same Material as Pipe

It was very desirable from an operating and maintenance standpoint that weld spatter be avoided inside the pipe and also, at the same time, full penetration be obtained at the bottom of the V. This was achieved through the use of chill bends or backing rings. These rings were of the ready-made variety, possessing the same characteristics physically and chemically as the pipe stock, in the form of a split band tapered at the edges, and having a central ridge which properly spaces the pipe ends and allows the pipe bores to align themselves. This chill ring also serves as a nucleus for fusing in with the first bead. Although simple and inexpensive, it has proved to be entirely satisfactory from an erection standpoint.

In the welding of thick-walled pipe, investigation proved that the deposition of several layers was much more satisfactory than the use of thick layers and relatively few passes. The use of several layers aided in securing a sound weld on two counts: (1) it practically nullifies the possibility of porosity, and (2) a fine grain structure is obtained by the heat of successive layers.

### Successive Beads Cleaned and Smoothed

Particularly with this type of weld, is there a necessity for cleaning each successive bead in order to remove the coating of slag. This is usually done by hand with a wire brush or light hammer, following which the bead is smoothed with a pneumatic chipping tool and any unfused portions cut out to sound metal. This chipping operation may give some peening effect, but it is carried out as a mechanical means of cleaning and smoothing the unfused areas rather than for any value it might possess for strain-relief or grain-refining purposes. The final layer is chipped smooth and peened lightly to give a finish appearance similar to knurling.

Because of the possibility of over-fatigue to welders incurred in chipping with the pneumatic tool, it has been found advisable to have all this work done by a helper.

Probably next to the human equation, the success or failure of a weld depends most upon the proper stress-relief of that weld. This was demonstrated several times by the Ford Motor Co. in its laboratories. X-ray inspection of welds not stress-relieved always showed cracks over a period of time, especially in the case of steels containing molybdenum.

### Stress-Relieving Desirable, Even on High-Temperature Lines

The chief purpose in stress-relieving a weld for use at 900° F. is to reduce any locked-up stresses before placing the line in service, thus minimizing the likelihood of cracks starting in or adjacent to the weld. This condition obtains notwithstanding that the 900° temperature will materially reduce the magnitude of these stresses over a period of time. However, on such lines operating at 400° or lower, stress-relief of such joints is absolutely necessary.

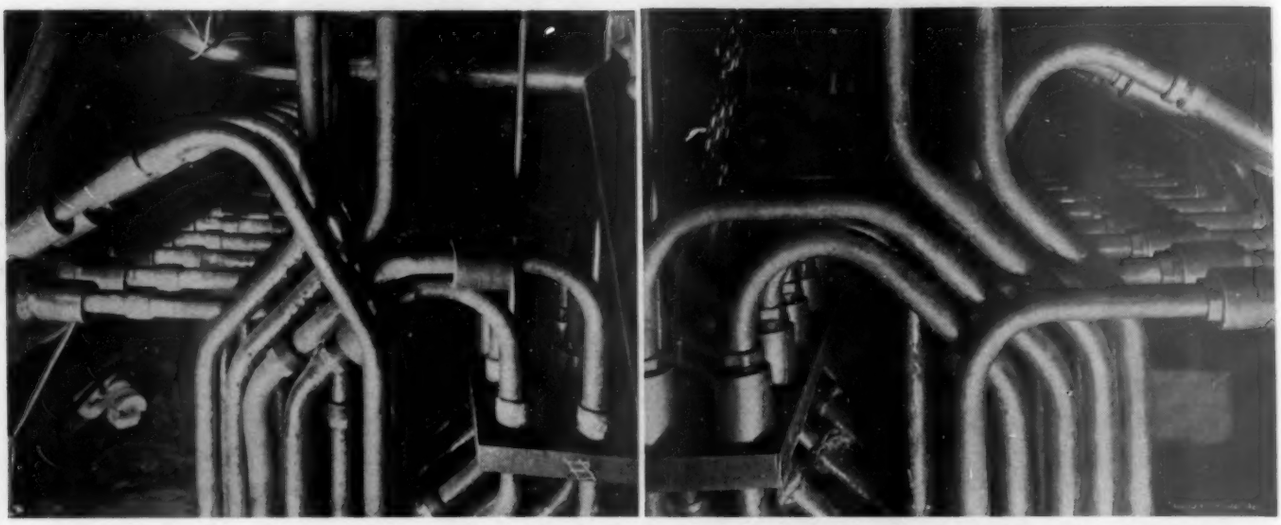
Stress-relieving was done with a portable 200-kva. annealing transformer. The stress-relieving collar is in the nature of a transformer in which the conductor turns comprise the primary circuit, and the weld and adjacent pipe wall a one-turn secondary, short-circuited on itself. When alternating current passes through the primary, it induces a much heavier low-voltage current in the one-turn secondary, thus developing heat where it is actually wanted. Means of adjusting the primary voltage is provided, so it is possible to bring the joint up to the desired temperature quickly and then to reduce the current and hold the temperature for any desired length of time, after which the current can be gradually decreased to give as slow cooling as may be desired. Thermocouples give the temperature on each side of the weld and also the temperature of the weld itself, which is recorded graphically.

The rule used on all the high-pressure pipe welds for stress-relieving is to hold the material at a temperature of 1150° F. for an hour per inch of wall thickness of the pipe. It was found further

**Steam-Line Primary Valve Welded Into 15,000-Kw. Unit.**

**Completed Weld on High-Pressure Line.**

**Branch Auxiliary Line Connection Welded in the Shop**



**504 Position Welds Were Made in These Superheater Tubes. At Left Are Shown Some of the Completed Welds, and at Right the Welded Joints Have Been Covered With Couplings.**

that reasonably slow cooling to room temperature (about 90° per hour in this case) is beneficial. Gradual cooling is easily obtained with the induction collar annealer, since the current may be tapered off gradually.

In applying welding to the superheater tubes, the Ford Motor Co. showed their extreme confidence in the welded joint. On this unit there are 168 convection elements and 84 radiant elements of 2 in. outside diameter. On these two elements a total of 504 welds were made, on the superheater nipple 168 welds, and six more on the superheater drain connections. This superheater was hydrostatically tested at 2,600 lb. per sq. in. and held at that pressure for several days. Each joint was then inspected by several qualified inspectors and not a single leak was found.

## Economizer, Condenser and Evaporators Are Welded

The economizer, usually a source of trouble owing to leaky connections, was also of welded construction. In this unit there were 160 welded joints of 2 in. outside diameter, 80 welds to the nipples and 4 welds to the safety valves, thus making a grand total of 926 welds within the boiler alone, and not the slightest leak developed on test.

The condenser, a single-pass unit built by the Worthington Pump & Machinery Co., was constructed of copper-bearing boiler plate having a tensile strength of 50,000 to 60,000 lb. per sq. in., and is said to be the largest welded single-pass condenser in the world. This welding also was supervised by the Ford Motor Co.

The three evaporators, also entirely welded except for the heads, are made of 1⅛-in. plate, similiar to that used in the condenser. It was welded by the automatic metallic-arc process on all girth and longitudinal seams. On the inside of the shell, a seal bead was laid along all seams by hand, all welds being made flush with the inside surface of the plate. These evaporators were stress-relieved in specially constructed furnaces at 1150° F. for one hour. All seams were x-rayed, and the vessels were tested hydrostatically to 1½ times working pressure. These units were fabricated in the shops of the Foster Wheeler Corp. under the direct supervision of the Ford Motor Co.

## All-Welded Construction for Auxiliary Heaters

The high-pressure heater and crossover heater are primarily of the same construction as the evaporators. They are of all-welded construction, except the heads, which are forgings. They also are products of the Foster Wheeler Corp.

In the piping from the boilerfeed system, consisting of 6, 8, and 10-in. pipe, there is a total of 50 welds. From the boiler to the turbine there is a total of 67 welds in pipes of 10 and 12 in. diameter. Also included in this system is the 20-in. main process-steam line in the tunnel, in which there are 184 joints, all welded, and also 18 18-in. joints.

**Welding a Branch Connection on the Manifold for Generator-Air Coolers.**

## No Leaks Developed in 1,600 High-Pressure Welds

A grand total of about 1,600 high-pressure welds were made in this installation, in which seven tons of welding rod was deposited. Insofar as tests have progressed, none of the joints have showed any tendency to leak.

In the making of fixed-position welds, the procedure depends on whether the pipe is horizontal or vertical.

## Procedures for Making Welds in Fixed Position

If the pipe is in a horizontal position, so the weld lies in a vertical plane, the first step is to lay a bead penetrating both the side of the pipe and the backing or chill ring. Such a bead is laid on both sides or shoulders of the chill ring. Then these two beads are joined with a third in the middle, and by proper penetration the three beads are tied in. These first three beads are made with ⅛-in. electrodes, and the following layers are made with 5/32-in. electrodes. A chipping tool is used to clean up the metal already deposited, thereby doing away with any possibility of slag inclusion or porosity. The next step is to deposit a wash bead which entirely covers the first three beads, penetrating or cutting off 50% of the original pass and penetrating the pipe to a depth of approximately 3/16 in. The next successive layer is in two beads covering the width of the weld, it in turn being covered with a single wash bead, alternating until the required deposit of weld metal is made. This usually consists of 12 continuous passes, making 7 layers. It is important that in all passes the penetration be approximately 50% of the previous bead and about 3/16 in. on the sides of the pipe.

Tests have shown that the weld material itself is equal to 95% of the tensile strength of the pipe metal, with proper care used in welding, so it behooves the welding operator to secure good penetration at the pipe in order to secure a strong weld.

When the pipe is to be welded in the vertical position, with the weld itself horizontal, another problem is presented. In the vertical weld just described, the operator has gravity in his favor, thereby allowing the use of a larger puddle of metal and better control of it. In the horizontal weld, he does not have this advantage. The initial three passes are the same as in the vertical weld —that is, both shoulders of the chill band are welded to the sides of the pipe and the two beads are tied in with a third down the middle. From here on, the horizontal weld differs only in size and number of beads. Instead of the wash bead, several successive small passes are made—usually 45 passes, making 11 layers. The use of several passes results in absence of slag inclusions, no porosity, and refinement in grain structure afforded by the heat of each successive layer.

### Shop-Welding Procedure Similar to Making of Vertical Welds

Of course, in the shop weld, all pieces can be easily turned to any desired position. The ideal position for the electrode in this case is 30° off of top dead center of the pipe, thus allowing the slag to flow or fall off ahead of the deposited metal. Inasmuch as gravity can be put to use, and the puddle is easily controlled, the shop welds are made similar to the vertical weld as to the number of passes. As in the position welds, 1/8-in. electrodes are used for the first three passes and 5/32-in. electrodes for the remainder. Welding heats are constant in all three welds, the only variable being the length of the arc.

## Rebuilds Broken Locomotive Cylinder Without Removal

The rebuilding of the front end of a 25x26-in. cylinder on a big Pacific-type passenger locomotive, was an outstanding welding job recently completed in the Illinois Central Railroad shop in Memphis, Tenn.

The repair was made necessary by the breaking of the wrist-pin of the engine, causing the piston head to crash through the cylinder head, ripping out all the stud-bolts and breaking a good-size piece out of the front end of the cylinder extending to a point behind the front port-hole. A flat wedge-shaped piece, forward of the port-hole and extending up to the steam-chest,. was completely torn out.

The first step in making the repair was to pack and build up the torn-away

**Steam Cylinder Rebuilt by Welding.**

port-hole with wet fire clay. Next, the entire cylinder and steam-chest was enclosed in an especially built brick furnace and gradually heated to approximately 400° F., and this temperature was maintained as uniformly as possible while the work was in progress. An opening was made in the front of the furnace just large enough to permit the welders to get to the damaged part of the cylinder with torches and welding materials.

The parts broken out of the cylinder were either lost or too badly shattered for re-use, so it was necessary to rebuild all the upper portion of the cylinder from the port-hole forward, and to plug all the stud-holes and rebuild out the entire front of the cylinder for machining.

The piston head also was damaged and required some welding as well as rebuilding up to a size where it could be re-machined.

The welding, reboring and machining of the damaged cylinder were performed without removing the cylinder block from the locomotive, and the locomotive was out of service only a few days.

The Illinois Central System at present is employing 25 full-time welding operators in its shops and yards at Memphis. At stated intervals each welder is required to make a test weld, which is stamped with a number and tested in the testing shop, where a record is kept of each operator's tests.

## Models Aid Designers of Machine Tools

The proper design of any machine or structure requires that we predict what forces will act upon the completed assembly and the conditions under which those forces will be active, pointed out Fred L. Plummer, associate professor of structural engineering, Case School of Applied Science, before the December, 1936, meeting of the American Welding Society, Cleveland Section. It is then necessary that we determine the stresses and distortion which will be created in the structure by the applied forces. Finally, we must select the material and determine the amount and shape of that material which will most efficiently provide a safe and useful service life for the projected machine or structure. Included in this final step is the selection and design of proper connections so that the parts of the structure may be assembled and may act as a unit.

Early methods of fabrication are largely responsible for a design tradition based on empirical and "rule of thumb" procedures. Newer methods of fabrication, together with the increased use of high-strength metals, make more exact methods of analysis and design essential if our machines and structures are to be economical and at the same time provide satisfactory service records, Mr. Plummer pointed out.

The advantages of using models was brought out by Mr. Plummer. The designer of machine tools will find many types of model studies to be of great aid in executing his designs. Three-dimensional models built of identical or similar materials may be loaded and tested just as the full-scale structure might be tested, he said. Models made of brittle material having a constant stress-strain relationship up to ultimate strength are useful in determining stresses on complicated sections. Rubber models may be used to demonstrate and study distortions. Several useful analogies have been developed which enable the designer to solve stress-distribution problems by observation of electrical, hydraulic, or other phenomena.

The photoelastic method was also mentioned as being especially valuable to the designer of machines because it enables him to determine and therefore avoid the points of stress concentration which have so frequently resulted in fatigue failures of machines involving reciprocating or rotating parts.

# Coming Events

**Mar. 3-5. Columbus, O. Sixth Annual Welding Conference of The Ohio State University, with exhibits. For information write O. D. Rickly, Asst. Prof. of Industrial Engineering.**

**Mar. 15-18. Chicago, Ill. National Railway Appliance Exhibition.**

**Mar. 15-19. Philadelphia, Pa., Convention Hall of the Commercial Museum. National Oil Burner and Air Conditioning Exposition.**

**Mar. 18-19. Lawrence, Kan. Third Annual Welding Conference of University of Kansas. For information write A. H. Sluss, Professor of Mechanical Engineering.**

**Mar. 24-26. Ames, Iowa. Ninth Annual Welding Conference of Iowa State College, with exhibits. For information write D. C. Faber, Director, Engineering Extension Service.**

**Apr. 8-11. Minneapolis, Minn., Auditorium. Northwest Automotive Maintenance Show. For information write H. H. Cory, 303 Tribune Annex, Minneapolis, Minn.**

**May 3-7. Milwaukee, Wis., Municipal Auditorium. Annual Convention of American Foundrymen's Association. For information write C. E. Hoyt, Secretary, 222 W. Adams St., Chicago, Ill.**

# Progress in Overland Pipeline Welding by the Oxyacetylene Method . . .

From a paper read before the International Acetylene Association convention in St. Louis, Mo., Nov. 18-20.

By T. R. JONES
President, T. R. Jones., Inc.

ENGINEERING research and the development of testing equipment, together with the introduction of alloy-steel welding rods, plus stringent qualification and inspection methods, have placed the oxyacetylene welding of pipelines into a position really remarkable for the consistency with which high quality of workmanship can be obtained under the exigencies of field welding conditions.

## Field Organization Is Based on Speed and Efficiency

Pipeline welding is production welding in the literal sense of the word. Consequently, the field organization which would be used is influenced by the result to be gained, which is primarily the maximum number of welds, or, in other words, the maximum footage along the right-of-way per working day. The pipeline organization has been built around the old ripple-welding methods and has consisted of three primary elements: (1) the line-up gang; (2) the firing-line or welding gang; and (3) the laying gang.

The function of the line-up gang is to align the pipe on skids and dollies and tack weld these joints sufficiently to retain the alignment during the welding operations.

The firing-line gang is the production organization. The pipe is turned or rolled as the welds are made and a sufficient number of firing-line welders are employed to give the required daily footage along the right-of-way. When ripple welding was commonly practiced five or more years ago, this welding organization would consist of 8 to 12 or more welders, and it was the practice to team these welders together in groups of four on a single roll or section of pipe. Of course, at that time the linear speed of welding was considerably less than what we are obtaining today. Therefore, it was entirely feasible to gang these men together as a single group. Unfortunately, this was not particularly conducive to high welding speeds, since if there were one or two men on the "roll" who were slower than the others, the rate of welding was set by the slow men.

The laying gang follows the firing line. The function of this organization is to bend the pipe to fit the terrain of the ground, align succeeding sections in position to be tack welded together, and then these bellhole or tie-in welds are made by a small welding organization consisting of two or three men.

This is essentially the organization that is used today under the term of roll-welding or "storm gang" operation. Many advances have been made in oxyacetylene welding during these ensuing five years, having to do principally with the speed of welding, or, in other words, an increased output per welder per day.

On This 10-Mile 12-in.-Diameter Line Being Installed by the "Stab-On" Method, Individual Joints Were Lined Up and Welded in 9 Minutes.

Joining Pipe Into 40-Ft. Lengths by Multi-Flame Welding.

Some adjustment has correspondingly been made in the pipeline organization, but essentially these same three elements have been retained.

## Lining-Up Operations Taxed by Increased Welding Speeds

I can see certain defects in this organization from the standpoint of efficient operation. The increase in output per welder has gone up 300% to 400%, with the result that the firing-line organization now consists of only four welders. Even with only four welders on this gang, a considerable burden has been placed upon the line-up organization to provide pipe in sufficient quantity to enable the line-up to keep ahead of the firing line. The size of the line-up gang has been increased and more mechanical equipment employed in an endeavor to keep up with the pace set by the firing line. The consequence has been that it costs nearly as much in dollars and cents to line and tack the pipe, as to weld it.

The increase in welding speed has had further complications. It is no longer possible to team a considerable number of men together on a single roll. Today's demand for high-quality welding dictates the use of a single welder to a section. Each welder has his own helper, who turns the pipe to suit the welder's

requirements. Because of the high linear welding speed, the pipe must be very carefully and very accurately aligned prior to tacking. An even spacing around the circumference of the joint is absolutely essential in order that the penetration of the weld metal will be maintained down to the very root of the weld.

### Sun's Heat Causes Differential Expansion of Pipe

In hot weather this accuracy in alignment is complicated by the effect of the sun on the pipe. Sun temperatures in the mid-continent area will get as high as 130° to 140°. This heat on one side of the pipe causes a differential expansion to take place, which results in the pipe bowing slightly, becoming what in pipeline phraseology is called "rainbowed." We attempt to minimize this effect as much as possible by having the pipe ahead of the line-up gang frequently turned so that there will be less differential temperature between opposite sides of the pipe.

It is not uncommon for the firing-line gang to progress 18,000 to 22,000 ft. along the right-of-way per 9-hour day. In rough country, this is greater speed than the laying gang can keep up with. For example, on the recent 178-mile 6-in. gasoline line for the White Eagle Oil Corp., the entire line was "fired out," leaving the laying gang approximately 100 miles behind.

These factors would seem to indicate that there is an element of unbalance with our present organization technique. Some 12 or more years ago, a few short lines were ripple welded, using an entirely different organization set-up. These welds were all bellhole welds. In other words, the conventional line-up and firing-line organizations were dispensed with completely and all the operations consolidated with the laying gang. This method was not feasible at that time because ripple bellhole welds were extremely slow to make, with the result that the daily footage was cut down to a mere 1,500 to 1,800 ft.

### Stove-Piping Method Gains Converts

However, bellhole welds can now be made by the newer methods almost as rapidly as rolling welds. In fact, there is but a 10% to 20% penalty in the way of increased welding time required to make our present-day tie-in welds. Consequently, the all-bellhole-welding method has been gaining a considerable amount of attention. I have used this procedure with my own organization in the laying of a good many relatively short lines in the state of Texas, and recently applied it to the laying of 50 miles of 10-in. line in Kansas for the Texas Empire Pipe Line Co. These represented fairly large-scale operations,

**The Entire Line-Up and Tack-Welding Crew Are Well Bunched on This 49-Mile All-Bell-Hole Job.**

and a careful analysis was made from the standpoint of efficient organization and low cost of operations. This method of pipe lining, known as "stove piping" in the field, involves considerable departure from the older practices. The bending gang is moved up to the front end and consolidated with the line-up and tacking gang, while the firing-line and bellhole gang have been consolidated into a single welding organization. The pipe is bent either in single- or multiple-joint sections and aligned in position on skids over the open ditch. When properly aligned, the joint is tacked and the front-end gang moves on to the next joint.

### All Operations May Be Confined to Small Area

Some distance behind the front end, is the welding organization. This distance may be anywhere from a few hundred feet to a third of a mile, depending on right-of-way conditions and the number of bends that have to be made to fit the pipe to the ground contour. No particular difficulty is experienced with rainbows in the pipe, and the use of dollies is dispensed with completely because the pipe is not rolled as it is being welded. All the operations are consolidated within a relatively narrow area, with the consequence that better supervision can be maintained from one end to the other. The daily footage is reduced somewhat over the older storm-gang methods; but the overall progress of the completed line, ready to be lowered into the ditch, is equivalent to that obtained by the usual laying-gang organization.

With technical improvements in the welding process which have increased bellhole-welding speed, it would appear that improvements are necessary in the purely mechanical operations in order to keep pace with present-day welding ability. There are two factors which tend to reduce progress with the stove-pipe method. These are the speed with which the pipe can be bent, and the footage of ditch that can be opened per day. Anything that can be done to speed up these operations will enable the contractor to weld increased footage at lower costs. Ditching machines are kept running 24 hours a day at the present time, and frequently the welding is held up because of lack of sufficient ditch.

### Favors Single-V Butt Welds for Gas-Welded Lines

Oxyacetylene welding has always favored the open-butt-joint design from the standpoint of simplicity, low costs, and high overall joint efficiency. Bell-and-spigot pipe was used on a few lines some years ago but was discarded in favor of the double bell and inner liner. Double-bell pipe has been retained in a few instances, either because of the desire on the part of operating engineers to use arc welding with an inner liner or chill ring for backing-up purposes, or because of the viewpoint of some oil-company engineers who felt that this design increased the overall joint efficiency. However, many of us are pretty well agreed, as a result of thoroughly exhaustive tests, that maximum joint efficiency is obtained from the single-V butt weld.

### Chill-Ring Liners Not Always Desirable

It seems to me that more consideration should be given to the open-butt-joint design for the welding of large-diameter lines, particularly for gas transmission. I believe it has become substantially a standard practice to require the use of chill-ring liners with plain-end pipe in 16-in. and larger sizes. Certainly the practices in the mid-continent area in the laying of oil, gas, and gasoline lines during the past 5 years have adequately demonstrated the consistent strength of the open butt joint, as exemplified by probably 6,000 miles of line which have been laid by a recently developed, speedy method of oxyacetylene welding being employed by our organization.

Possibly some confusion exists as to the necessity for chill-ring liners in these large-diameter gas lines. Whether the welding process is electric or gas, there is a joint design pertinent to each process whereby that particular process can be applied most economically or most efficiently. It so happens that arc-welding costs can be considerably decreased through the use of a backing-up strip or chill-ring liner.

The insistence upon this liner for use

in conjunction with oxyacetylene welding, however, amounts to the same thing as putting a penalty on gas welding. This is not the joint design which is most acceptable and most economical for gas welding. Assuming the one process to be substantially equivalent to the other when properly applied, I find it rather difficult to appreciate the line of reasoning which demands a chill-ring liner for large-diameter gas lines, regardless of which welding process is to be employed.

### Pipe Materials and Fabrication Methods Are Improved

The last few years have witnessed some interesting developments in pipe materials and pipe fabrication. Practically all new pipe is today specified as Class B. This material has a nominal tensile strength of 60,000 lb. per sq. in. minimum—actually the tensile will be closer to 72,000 lb. per sq. in. Lap-welded pipe has practically disappeared, and in its place is either seamless or electric-welded pipe. Apparently much more attention is being given by the mills to their fabricating methods, since pipe ends are more accurately sized than formerly and but very little trouble is experienced nowadays with egg-shaped ends.

The higher-strength material has led to the substitution of lighter-wall pipe for equivalent operating conditions. Part of this trend toward lighter-wall is due to these improved physical characteristics and part, in my estimation, to a more scientific attitude toward soil corrosion. Coating materials have been considerably improved, and some of the oil companies, in their efforts to combat corrosion, are making soil surveys along the right-of-way, determining scientifically to what extent wrapping or coating shall be used. This is a very logical step, for considerable money can be saved not only in the gross tonnage of steel required for a given line, but also the freight charges on this tonnage.

In all likelihood some consideration will be given in the near future to the use of Class C material, having still higher physical properties, as we develop the technique for combating corrosion effects. If and when this material, having actual ultimate strengths in the neighborhood of 85,000 to 90,000 lb. per sq. in. becomes a reality, we may encounter problems in welding this material to obtain welded joints as strong as, or stronger than, the metal being joined.

### Composite Construction Has No Advantage Over All-Welded Design

The pipeline contractor, through his close-range association with all the engineering aspects of pipeline construction, maintains a better perspective, it seems to me, regarding some of the aspects of this work than do the engineering organizations who draw up the specifications. There has always been a difference of opinion among contractors, on the one hand, and the oil or gas industry on the other, as to how far we should go in the employment of solid welded construction. Practically everyone concerned is in agreement that pipe sizes up to and including 12 in. can be laid solid welded without any concern for contraction stresses. But when we get into larger-diameter pipe, it is said we must use composite construction.

Personally, I cannot see the argument. The whole technique of laying a pipeline is directed toward putting the line in compression before, and as, it is back-filled. Of course, most of the problem is in putting the compression where you want it, but this is simply a matter of laying technique. It is just as easy to put slack in a 16- or 24-in. line, as in a 6- or 8-in. line if the ditch is dug wide enough and deep enough. But it is an extremely hard matter to sell that idea to the pipeline companies.

### Field Tests of Spiral-Welded Pipe Show Interesting Results

Some field experiments conducted during the past two years in the laying of large-diameter spiral-welded pipe may have considerable influence on the question of "whether to weld or whether to couple." This pipe has an upstanding ridge where the spiral weld is made, and this method of fabrication gives a certain amount of flexibility, thus withstanding expansion or contraction. Several short lines up to several miles long have been constructed of 24-in. pipe, solidly welded together and laid into the ditch, without any attempt made whatsoever to put compression on the line. This pipe develops an excellent ground friction owing to the upstanding seams, and practically no movement can take place after back-filling. These tests, I understand, have been carried practically to the point where all concerned are convinced of the feasibility of laying lines of any length by this method.

Oxyacetylene welding has made tremendous strides during the past five years through the development of new welding techniques and the introduction of multiple-flame welding equipment. As I view the matter, these new methods stand completely apart from the old conception of gas welding, and represent a vast improvement in the metallurgy of the deposited metal, and increased weld-metal tensile strength, ductility, and soundness. In view of these results, I wonder if the oxyacetylene interests have been progressive enough in bringing those developments to the attention of the oil industry.

Codes of good welding practice have been drawn up by the American Welding Society, the American Society of Mechanical Engineers, the American Standards Association, and others, all aiming to control weld-metal quality and reduce to the minimum the human elements inherent in any manual process of welding. Pipeline welding does not come directly under any of these code requirements. Over a period of years the pipeline fraternity has developed its own methods for securing consistent weld-metal quality.

### Welds Must Be Strong and Durable to Prevent Expensive Failures

Operating stresses on overland lines are fairly high. In a good many cases pressures in oil lines are carried up to 700 or 800 lb. per sq. in. I presume that the usual process-piping specification for these high pressures would require extra-heavy pipe. However, pipe having a wall thickness of only ¼ in. and a diameter of 12 in. is actually being used for these high-pressure operating conditions. There is, of course, no particular hazard to human life should failure of either the weld or the pipe material occur. But you can readily appreciate that main-line failure would be extremely expensive for the pipeline company.

Certainly, if any failure should take place, we do not want it in our welds. Therefore, welders are given an extremely stringent qualification test prior to their working on the line. The principal aim of welding inspectors during the process of construction is to maintain the same high quality of workmanship demonstrated by the qualification tests. Welders who successfully qualify have to make a weld in the same pipe material which will be employed on the line. After this weld is made, whether it is a rolling weld or a bellhold weld, four coupons for tensile test are cut. The first coupon is taken at the completion, or seal-off, of the weld, and the other 3 are spaced equidistant around the circumference of the joint. A portable tensile-testing machine is used and each coupon pulled to failure.

### Test Coupons Are Required to Fail Outside the Weld

In order to qualify, at least three of the four coupons must break in the pipe material. On some jobs all four are required to break in the pipe, but this requirement is a little too severe. In this procedure, no attention whatsoever is paid to the actual tensile strength developed during the test. The sole requirement is that the coupon must fail in the pipe. Since Class B pipe, with a specified strength of 60,000 lb., may have an actual strength of 72,000 to 75,000 lb., it is conceivable that coupons might fail in the weld at a strength substantially higher than that of the specified strength of the material. But this is entirely beside the point; failure in the weld disqualifies the coupon.

The inspection routine follows this

same procedure. Complete welds are cut out of the line at the inspector's discretion and four coupons, as above, are given a tensile test. The test requirements are generally not quite as stringent during the course of construction as those required for qualification, though the welder, after qualifying, is usually permitted to have not more than one strap out of any individual test weld fail in the weld metal. Of course, all welders are given a designating number and this number is stenciled on the pipe at the completion of each weld. The pipeline inspector is continually observing the welding operations, and the welders themselves do not know at what time one of their welds might be marked for cut out and test.

It is surprising how this sort of procedure stiffens the backbones of these mid-continent welders. Because their welds are subject to test at any time, they are constantly on their toes, and welding quality is consequently maintained at an extremely high level. Though this procedure does not have all the dignity of formal welding-code requirements, yet it gets the job done.

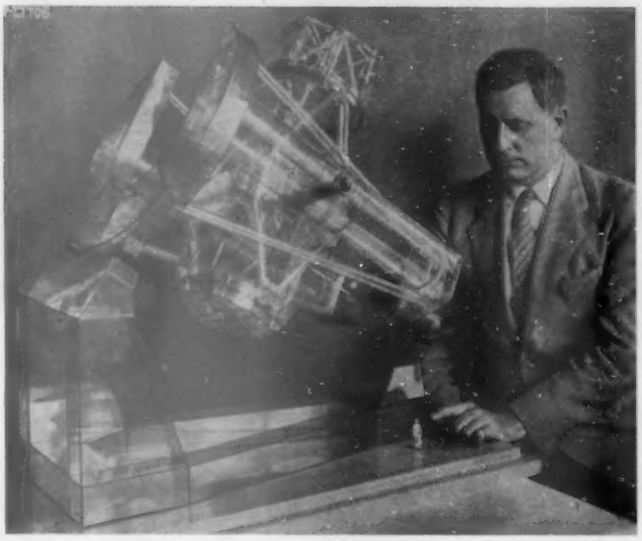
## World's Largest Telescope to Have Welded Frame

There will be no rivets in the steel work of the 7½-story superstructure for the world's largest telescope, when it is completed on Mount Palomar, California, in 1940. The immense parts of the mounting, which can be sent to California only by water from South Philadelphia, will be welded together. They will travel the 125 miles overland from the California coast in trucks capable of carrying 100-ton loads, and special roads will be built to allow passage.

These are but a few of the salient features of the world's largest precision instrument, which is being constructed from a grant of $6,000,000 made in 1928 by the Rockefeller Foundation, under the direction of Dr. George Ellery Hale. The giant lens was cast some months ago at the Corning Glass Works, Corning, N. Y., and the interesting superstructure is being turned out at the South Philadelphia works of the Westinghouse Electric & Manufacturing Co. These parts of the huge telescope will be assembled by welding at Mount Palomar.

This new instrument may not settle the age-old controversy of whether Mars and the moon are inhabitated, but it will have much to do in determining if space comes to an end far distant in the heavens. Such is the line of thought advanced by Jesse Ormondroyd, Westinghouse engineer, who has a small-scale model of the 200-in. telescope.

"By far the greatest advance in astronomy, this giant telescope will enable man to see twice as far into the heavens, enabling him to glimpse eight times as many stars and showing all the heavenly bodies in a light much brighter than has ever been possible before," Mr. Ormondroyd explained in an interview.



**An Idea of the Huge Size of the Telescope Can Be Gained by Comparing This Model With the Figure of the Man Standing on Its Base.**

Pointing to a model of the telescope, Mr. Ormondroyd commented on the theory by Einstein that the universe is finite, that space is limited, and said:

"By going far beyond the realms studied to date, it may be that this telescope will enable scientists to find out definitely whether space is finite or infinite," he said. "With the great distance of penetration it affords, perhaps some day in the future we will be able to glimpse a place where stars and other bodies in the skies begin to thin out.

"Of course, this is only a possibility, but it does illustrate the type of thing such an instrument will offer for the world's men of science."

The 200-in. reflecting mirror is now in California being ground. The remainder of the structure, weighing approximately 1,000,000 lb., will be ready for use in 1940, when the complete plant will be set up at Mount Palomar. Headquarters for staff workers will be on the campus of the California Institute of Technology.

With the telescope it will be possible to see objects one billion light-years distant, whereas it is now possible to see but half that distance.

"This telescope," Mr. Ormondroyd continued, "has not been designed to study the planets, but was built primarily to study outlying universes and any other bodies lying in remote fields." Under ideal conditions, it was pointed out, the moon can be brought within 24 miles of the earth.

# News of Welded Pipelines

Oxyacetylene welding by the Lindeweld method will be used on the following recently announced lines, according to The Linde Air Products Co.: 14 miles of 20-in. gas line in the Texas Panhandle to be built by Maddux Brothers for the Shamrock Oil & Gas Co., to run from the company's Dumas plant southeast toward Borger; 20 miles of 8-in. oil line being built from Webster Station to Texas City, Tex., by William Brothers for the Stanolind Pipe Line Co.; and 7 miles of 10-in. oil line to be laid near Eunice, N. M., by Kelly Dempsey & Co. for the Gulf Refining Co.

The Truman-Smith Construction Co., Eldorado, Kan., will soon complete the new Stanolind pipeline between Centerville and Fontana, Kan. This loop is 14 miles in length. The line is 12 in. in size and is to be completely arc welded, including the bell-hole welds.

Contracts for arc welding all the field joints in a total of 103 miles of pipeline were recently awarded H. C. Price, Inc., of Bartlesville, Okla. One of the lines consists of 72 miles of 10-in. pipe being laid by the Apex Construction Co. for the Humble Oil & Refining Co., near Port Arthur, Tex., and there is 31 miles of 24-in. gas line being laid near Borger, Tex., for the Phillips Petroleum Co.

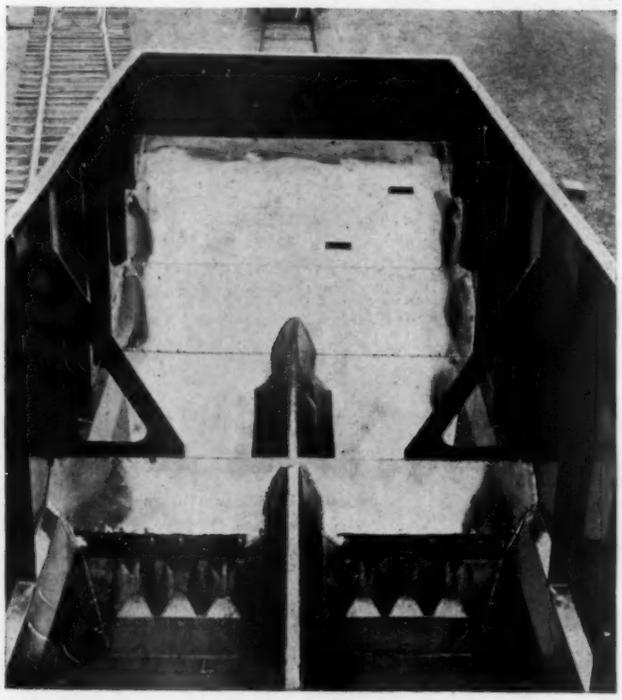
The Humble Oil & Refining Co. (of Texas) will soon lay a 120-mile 10-in. welded gas line from the Tomball oil field to Houston, Baytown, Port Arthur, Beaumont and Port Neches. The contract will use 12,000 tons of steel which will be furnished by the National Tube Co., of Pittsburgh.

The Shell Pipe Line Co., of Houston, Texas, is laying a 75-mile 10-in. welded pipeline from Wink to McCamey, Texas.

# Light-Weight Hopper Car Increases the Pay Load . . . .

## Welded Construction with Low-Alloy Steels, Makes Reduction in Dead Weight

By W. E. PALMER
Hollup Corporation



Floor Stiffeners, Slope and Hopper Sheets, and Other Parts of This Car Are Formed of Low-Alloy Steel, and Welded Together.

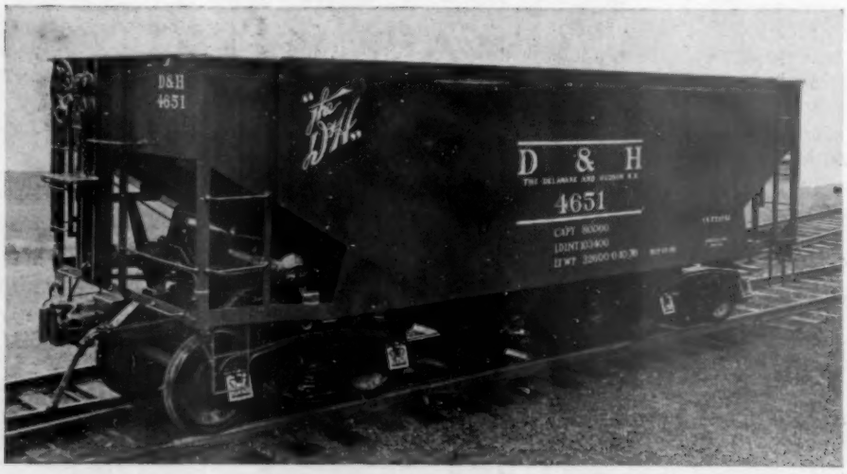
THE pronounced trend towards welded construction in railroad equipment has received considerable publicity of late insofar as passenger cars and motive-power equipment are concerned. Freight cars, while not widely publicized, have also been passing through a period of refinement with results that promise to prove more important than the more spectacular performances of streamline trains and air-conditioned passenger equipment. The importance of improved design and construction of freight cars is readily apparent when one considers that railroads operate 44 freight cars for every passenger car in service.

It was with the thought of decreasing the weight of freight equipment to enable trains to carry a higher pay load in proportion to their gross weight, that the Delaware & Hudson Railroad recently constructed an all-steel, self-clearing hopper car of 40 tons nominal capacity. This car was completed at the Oneonta shops on October 30, under the supervision of George Ditmore, master car builder.

The use of alloy steels and the arc-welding process enabled the designers and builders to construct a car which actually carries over 50 tons. The car rating is 40 tons because of the fact that under the rules of the American Association of Railroads cars with 5x9-in. axles are limited to this amount, 5½x10-in. axles being required under 50 ton cars because of the dead weight involved in the former conventional designs.

The new car meets all A. R. A. interchange requirements but weighs much less than the usual type, due to the use of welding and of alloy steels in both underframe and parts of the superstructure. The sills are A. R. A. type of arc-welded construction. The car weighs only 32,600 lb. and has 1752 cu. ft. capacity. The allowable weight on the rails for a car with 5x9-in. axles is 136,000 lb. A maximum load of 103,400 lb. is permitted, or a ratio of pay load to dead weight of 3.17 to 1. The car can carry 103,000 lb. of anthracite, figuring an average of 52 lb. per cu. ft. and the usual heap load.

Riveting gave way to arc welding, the number of rivets used being only 277 as against 2,576 rivets in a 50-ton steel hopper car of conventional design. A reduction in the number of parts used in the car was shown, there being 1,153 pieces used as against 3,596 formerly used. The saving in weight is made through the use of welding and of high-tensile alloy steels, especially in door frames, doors, and combination front and back stops. Cor-Ten and Yoloy




The New Hopper Car Has a Ratio of Pay Load to Dead Weight of 3.17 to 1.

steels were used to a great extent, and Man-Ten steel was used for the center sills.

The center sills are joined by a continuous weld at the junction of the two top flanges (A. R. A. "Z" type).

The body bolster parts, cross bearers, and floor stiffeners are also of Man-Ten steel, joined by arc welding. The slope and hopper sheets are of Cor-Ten and Yoloy steels, both being high-tensile, corrosion-resisting alloys. The side sheets are made of ordinary open-hearth steel, experience having shown that the side sheets of steel hopper cars require renewing after a period of 17 years, whereas the slope and hopper sheets have a service life of 12 years. The use of the alloy steels in the latter will help to duplicate the achievement of the side sheets in lasting 17 years, and the result will be that no one part will fail first. The hopper unit is strengthened by the use of doors and frames of cast steel. The car is equipped with "AB" type air-brake equipment.

The ideal car from a maintenance standpoint is one that will last until all parts can be repaired at one shopping. The welding, therefore, coupled with alloy steels does not present any obstacle to efficient maintenance to offset the obvious advantages.

## Oilwell Draw Works Unitized by Welding

By DWIGHT ABBOTT

One of the most important developments in the use of oilwell draw works in the Mid-Continent field during the past year, from the standpoint of the welder, has been the unitization of equipment for easy transport, according to Otto Hart, president of the Hart Welding Supply Co., of Oklahoma City, Okla.

The draw works proper is that piece of equipment which raises and lowers the drill pipe in the hole, and also turns the pipe during the drilling process. It is thus almost the "key to the situation," and must be constructed to bear the weight of upwards of 100 tons at a time, depending on the size of the well being drilled.

Typical of welded draw works are the assemblies being made for the Anderson-Kerr Drilling Co. under the direction of J. E. Rogers, welding foreman for the company, whose four-part set-ups have meant savings of thousands of dollars in labor costs, loss of parts, and time during the past eight months.

"The saving on parts alone is no small item," Rogers explained. "Under the old method, each part had to be taken down from one well and laid in a pile; then stacked in trucks and delivered to the new location, where they must be assembled again. Since there are more than 20 parts to the set-up, it was very easy to lose these quickly."

Welded Draw Works Completed and Ready to Be Moved.

Here Is What the Unassembled Draw Works Looked Like Before the Unitized System Was Developed. Loss of Parts Was Common.

Such an assembly made in the old way required the labor of 15 men, at approximately $100 a day, and about five days to rig one of the draw-works set-ups at the well. With the new welded units, the entire assembly is delivered in four solid pieces by truck, and can be set up in about a half-day's time.

Most important of the four units is the draw works itself, ranging from a small set-up for lighter work to large units weighing about 18,000 lb. The works, which are a completely welded article throughout, are placed on a set of skids, which serves as the base and facilitates loading and unloading as well as placement.

Also securely welded to the skids are the three other units necessary to the assembly—a set of pumps, a set of engines and the boilers.

Use of the skids alone have meant a welding advance of no small importance in setting up wells, Rogers pointed out. For the past year they have been mounting all equipment used in transport on welded steel skids. When wooden skids were used, they often had a serious breakage problem.

"The construction of a draw works such as that described above, is comparatively inexpensive," said Rogers, "especially when one considers the cost of assembly part by part which must be made for each new well about every 60 days. The welding time for building such a works involves about 100 hours of labor, and the materials include about 250 lb. of electrodes.

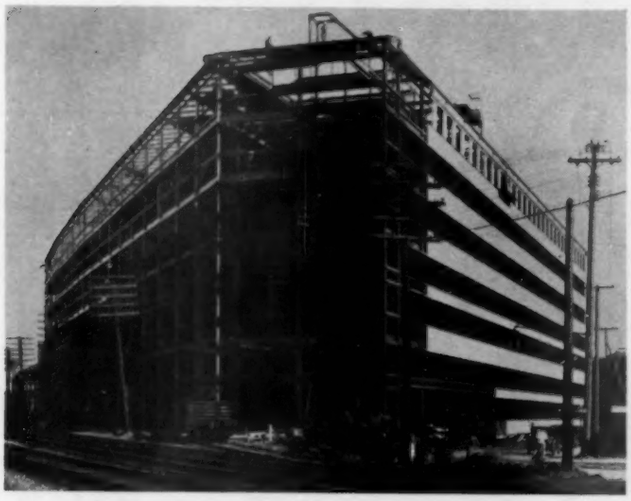
"Once welded, the works will last indefinitely. We have had one or two sets used on 15 to 18 holes that came through in just as good condition as at the start. The big problem successfully met by welding in building the set up has been that of withstanding the immense amount of strain and vibration to which the equipment is put."

This building of draw works, Hart pointed out, took the field almost overnight, and is now a feature of drilling activities in practically every section of the Mid-Continent area. It has meant an enormous boost in the sale of welding equipment and supplies.

## New Pamphlets on Safe Practices

Precautions are given on machine-shop hazards, in Safe Practices Pamphlet No. 13, recently published by the National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill. Information is given on installation of machines, their control, safeguards, care of machines and tools, handling material, electrical hazards, welding and cutting, fire prevention and clothing.

The proper and safe installation and use of grinding wheels is the subject of Safe Practices Pamphlet No. 13, also issued by the Council. This pamphlet covers abrasive-wheel accidents, protective equipment, hazards in the machine or wheel, inspection and storage of wheels, mounting of wheels, flanges, protection hoods, bands and chucks, wheel speeds, work rests, wheel dressing, grindstones, and polishing and buffing wheels.



# Westinghouse *Completes* All-Welded Building . . . .

By EDWARD H. SYKES
Pittsburgh Correspondent, *The Welding Engineer*

ONE of the largest all-welded, steel frame commercial buildings ever erected is virtually ready for occupancy at Mansfield, Ohio. It is the new warehousing and office building constructed by the Westinghouse Electric & Manufacturing Co. The towering structure, with its more than 300,000 sq. ft. of floor space, rises as a fitting symbol to the possibilities of arc-welded building construction.

Simplicity of design, coupled with many new building features, including air conditioning, marks the construction features of this new building, made necessary by present inadequate plant facilities. It will provide increased warehousing facilities and new offices for the expanding business of the Merchandising Division.

The building is triangular in shape, the sides of the right angle being 320 x 330 ft. A slight bend in the long side of the building makes additional space possible so that there is approximately 305,000 sq. ft. of floor space. It is 102 ft. high, although there are actually only five stories, since the first two floors have 24-ft. ceilings for warehousing purposes. Each floor has approximately 60,000 sq. ft. in floor space.

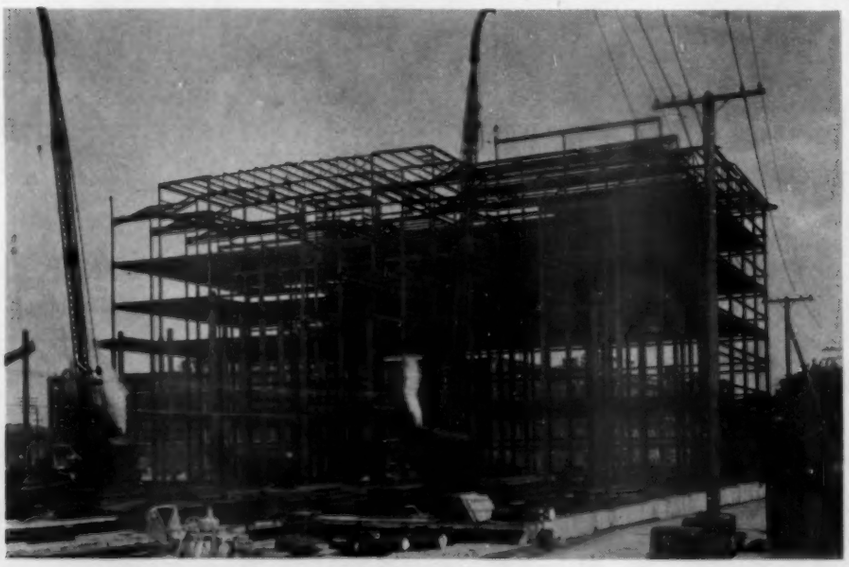
The building, of welded steel frame construction, employs a combination facing of corrugated asbestos sheeting and glass, and the solid framework, obtained by welding, makes possible high strength and rigidity.

The roof construction is of the saw-tooth type, with a glass exposure to the north.

A conveyor system takes the products from the manufacturing aisles, through an overhead bridge, to the first three floors of the warehouse. As these products come from the lines of production crated for shipment, they are transported over the conveyor system. This system also connects with the enclosed loading dock of the train shed, which occupies the entire west side of the building on the first floor, enabling the products to be taken from the production line directly to the cars, if they are not to be stored.

A cafeteria, with a capacity for serving 240 persons, is situated on the fourth floor, while the fifth floor is devoted to executive offices for sales, advertising, sales promotion and accounting departments. In addition to these offices, there is a large display room, eight small display rooms, experimental kitchens, and facilities for a Home Economics Institute.

The main entrance is on the north side of the building, and immediately facing the present warehouse. It is of modern design, of aluminum and black Carrara glass. The entrance and passageway open



into a ground floor foyer. A high-speed elevator conveys visitors to the fifth floor, where 60 private offices are located. The offices are equipped with a duct system for heating and cooling, and all the air used on this floor is filtered.

One hundred twenty-five tons of refrigeration furnish conditioned air for distribution throughout the working areas. The cooling equipment consists of six compressors, four of which are 25-ton units and two are 15-ton units. Two of the units are located for easy inspection by interested visitors.

# Meetings

### Chicago

"Application of Welding to Large Steel Tanks" will be the subject of a talk by H. C. Boardman, of the Chicago Bridge & Iron Works before a meeting of the Illinois Society of Engineers on Thursday, Jan. 28, at 2 p.m. at the Sherman Hotel. The meeting will be open to the public.

The meeting of the Chicago Section, American Welding Society, on Friday, Feb. 19, will be devoted to "The Relationship Between Base Metal and Weld Metal." It will be held in Mission Hall, Armour Institute of Technology, 47 West 33rd St., at 7:30 p.m.

At the meeting of the Chicago Section on Jan. 15, an open forum was held on the welding of non-ferrous metals, with W. B. Keelor, of the Ingersoll Steel & Disc Co., as chairman. Three discussion groups were held, these being presided over by W. C. Swift of The American Brass Co., F. D. Flocke of The International Nickel Co., and G. O. Hoglund of the Aluminum Co. of America. Preceding the technical meeting, two sound-movies were shown, illustrating some interesting sporting events with thrills galore.

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### Milwaukee

"Welding of Heavy Machinery" is the subject of a paper to be given by Harold Version, chief engineer, The Allsteel Press Co., of Chicago, before the Milwaukee Section of the American Welding Society, on Thursday, Jan. 21. Mr. Version will deal especially with composite structures consisting of castings and plates.

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### New York

Probably one of the best attended meetings ever held in the Engineering Societies Building took place on Jan. 13. It was a joint meeting sponsored by the New York Sections of the American Welding Society and the American Society of Mechanical Engineers, the subject being "Non-Destructive Testing of Welded Joints and Machine Parts."

The following papers were presented: "Radiographic Inspection of Welded Steel-Plate Construction," by Dr. Ancel St. John, of St. John X-Ray Service, Long Island City, N. Y.; "Magnaflux Inspection of Boiler Drums and Unfired Pressure Vessels," by R. F. Cavanagh, of the Fidelity & Casualty Co. of New York; and "The Detection of Fatigue Cracks by the Magnaflux Method," by T. C. Rathbone, of the Fidelity & Casualty Co. of New York.

Dr. St. John showed some new developments in equipment for conducting x-ray examinations and exhibited a few slides showing results of x-ray inspection, revealing porous conditions in the weld as well as unfused edges.

Mr. Cavanagh's paper described the Magnaflux method, which consists in magnetizing the part and after magnetization revealing defects by dusting Magnaflux powder on the magnetized part. Wherever a defect, either at the surface or within the body of the steel, existed, a line of Magnaflux powder revealed this defect. He also showed some slides of defects found in the large digesters and riveted boilers and explained the rapidity with which these large parts could be examined, at low cost.

Mr. Rathbone's paper dealt entirely with fatigue cracks in engine shafts, turbines, condensers and the like, and stressed the importance of the Magnaflux method to the insurance field. His paper also was a very fine treatise on vibration and its effect in the development of defects which could not be seen by the unaided eye or without use of a very high-powered microscope.

R. R. Moore, metallurgist, of the Naval Aircraft Factory at Philadelphia, described the experience of the Navy in their use of Magnaflux on aircraft parts, both on new parts and at the time of the overhaul periods.

The papers revealed that although the steel used in construction might be perfectly good, serious defects can be produced by either improper design or machining and other operations. The wide use of the Magnaflux method in a variety of fields was revealed by all of the speakers. Dr. Comfort A. Adams, member of the A.S.M.E. Boiler Code Committee, and chairman of the subcommittee on Radiographic Examination of Welded Joints, presided.

Future meetings scheduled by the New York Section of the American Welding Society are as follows: Mar. 2, discussion, the Bridge Welding Code; Apr. 13, "Shipbuilding"; Apr. 19, joint meeting with the A.S.M. on "Stresses in Welds and Their Elimination."

On Jan. 26 will be held another one in the series of lectures on "Fundamentals of Welding," arranged by the New York Section of the American Welding Society. This lecture will be on "Welding Non-Ferrous Metals and Alloys," by L. E. Abbott, of the Bell Telephone Laboratories. The Feb. 2 lecture will be given by G. H. Holbrook, of the Federal Shipbuilding Corp., on "Economics of Welding and Cutting." The concluding lecture in the series will be given on Feb. 9 by J. H. Deppeler, of the Metal & Thermit Corp., whose subject will be "Selection of Welding Process and Equipment," after which Prof. O. H. Henry, of the Brooklyn Polytechnic Institute, will summarize the value of the course. All lectures are being given at the Institute, 99 Livingston St., Brooklyn.

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### Philadelphia

J. G. Hartley, engineer, maintenance-of-way department, Pennsylvania Railroad, gave a paper on "Rail Welding" before the meeting of the Philadelphia Section, American Welding Society, held on Jan. 18. At the meeting on Monday, Feb. 15, F. G. Flocke, of The International Nickel Co., will speak on "The Electric Welding of Monel, Nickel and Nickel-Clad Steel." On Mar. 15, the Section will be addressed by Charles H. Jennings, of the Westinghouse Electric & Manufacturing Co., whose subject will be "Solving Manufacturing Problems by Welding." At the Apr. 19 meeting, a sound-movie on the manufacture, uses and applications of stainless steel will be given under the direction of T. R. Lichtenwalter, of the Republic Steel Corp.

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### Pittsburgh

A. E. Gibson, president of the American Welding Society and vice-president of The Wellman Engineering Co., of Cleveland, O., is to address the Pittsburgh Section of the American Welding Society on Wednesday evening, Jan. 27, in the Cardinal Room of the William Penn Hotel, on the subject "Why We Weld."

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### San Francisco

"How Welding of Low-Alloy High-Tensile Steel is Successfully Executed," was the general topic of two talks at the Dec. 18 meeting of the San Francisco Section of the American Welding Society, which was presided over by Chairman E. L. Mathy.

L. P. Henderson, district manager, The Lincoln Electric Co., spoke on "Arc Welding of Low-Alloy, High-Tensile Metals"; and C. S. Smith, district manager, The Linde Air Products Co., talked on the subject of "Oxyacetylene Welding of Alloy Steels."

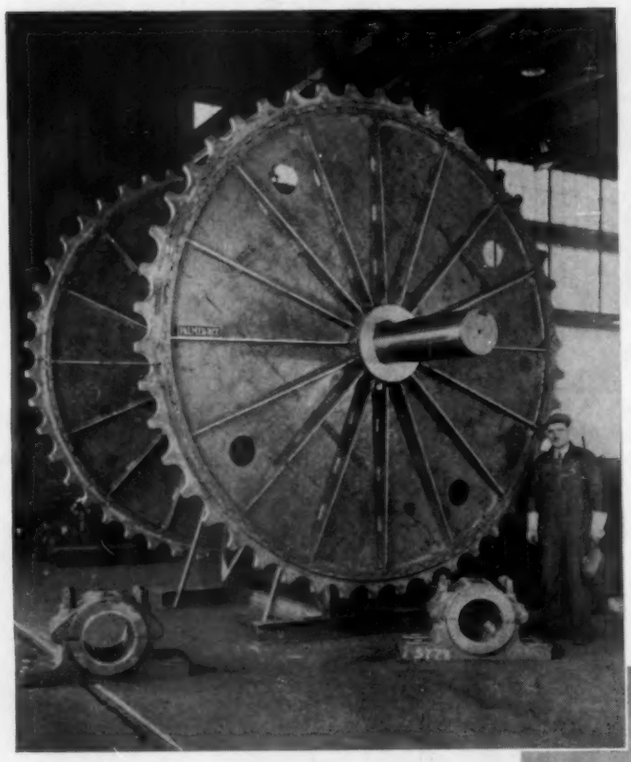
Following these talks, abstracts were given by K. V. King, in his usual interesting manner, from the November issue of the *Journal* of the American Welding Society and other important welding publications and literature.

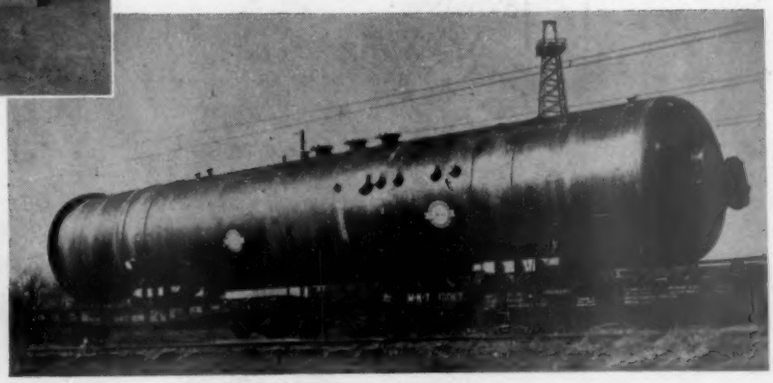
# Welding News in Pictures

• (Left) Building up crossing near Cornwall, Ont., at the intersection of the C. P. R. R. and C. N. R. R. The portable welder consists of a generator mounted on a Caterpillar tractor.

• This Christmas tree was assembled by arc welding, and erected by the Westinghouse Electric & Manufacturing Co. A composite tree, 31 ft. high, it is made up of 41 smaller trees, whose stems are inserted into 1½-in. pipe welded to the upright pipe forming the main trunk. It has 250 lights and is surrounded by a fairyland beautiful to behold.

• (Below) Fabricated by electric welding, this 13-ft. diameter sprocket is the largest ever made. The wheel rotates on a shaft 12 in. in diameter. (Photograph by courtesy of The Lincoln Electric Co., Cleveland.)





• The largest vessel ever built in the Mid-Continent oil field. It weighs over 216,000 lb. and is 12 ft. 6 in. in diameter and 86 ft. long. It was built according to A. S. M. E. code requirements for Class 1 vessels, in the Oklahoma City plant of Black, Sivalls & Bryson, Inc.

# Stack Cutting of Plate Material

## for Manufacture of Steel Parts Required for

# Heavy Repairs to Steel Freight Cars . . .

Paper read before the Annual Convention of the International Acetylene Association in St. Louis, Nov. 18-20.

By B. F. ORR
Superintendent of Beech Grove Shops,
Cleveland, Cincinnati, Chicago & St. Louis R.R.

TO MEET the demands of modern mass transportation, the railroads have had to set up heavy repair programs on production-line schedules with movements or deliveries of cars within time periods of from 18 to 24 minutes. The maintenance of the production-line schedules is dependent upon the ability of the fabrication department to furnish, on time, new material or parts for replacement of those that are unfit for further service.

The fabrication department is called upon to manufacture thousands of identical pieces during the course of a heavy repair program, and in this work the stack cutting of plate material by the flame-cutting machine has proved to be the greatest forward step that has been made in recent years. In our shop we are employing the flame-cutting process in the manufacture of freight-car parts that are fabricated from steel sheets or plates.

Stack cutting, as the term infers, means the cutting by the flame process of sheets or plates piled or stacked upon one another to a definitely determined height. It is, of course, evident that the cutting torch must be moved over the stack mechanically to obtain smoothly and accurately cut edges and, therefore, stack cutting is a machine operation.

Rivet "Washing" Is the First Step in Tearing Down Cars Preparatory to Rebuilding.

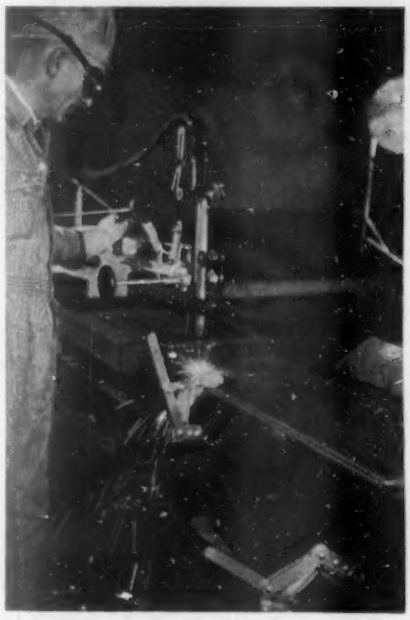
The machine installed at our shop has a cutting range of 81 in. transversely and 24 ft. longitudinally. This large capacity, provided to meet the production demands of the fabricating shop, permits the economical cutting of four different parts of large dimensions in progression.

### Large Templates Present Problems of Weight and Strength

The cutting machine is the type which is automatically guided by means of full-size templates, the guiding member being an aluminum rail suitably fixed to a base. As all the operations being performed by the cutting machine will be repeated at intervals, permanent templates have been constructed. Owing to the large size of the parts cut and the corresponding size of the templates, considerable thought and study was devoted to the development of a template base that would meet the requirements of both strength and lightness. The material selected is ⅜-in. plywood properly reinforced by ⅜ x 1½-in. strips attached to the under side with wood screws. The larger-size templates are made in skeleton form to reduce the quantity of material used and are so designed as to provide a secure base along the line of cut. When in use the templates are bolted to the top of the cutting-machine table, and only the original adjustment is required since the templates are positioned with relation to permanently located jigs and stops. A change from one operation to another consumes but a very short time as the templates can be exchanged without further adjustment of position.

### Plates Are Stacked on Jigs for Cutting

The stacks of sheets or plates are supported by jigs mounted upon channel-section beams extending the full length of the machine, these being supported in turn upon the work supports furnished with the cutting machine. The supporting jigs are constructed of ⅜ x 3-in. steel bars in skeleton form, the outline being slightly smaller than the contour of the part to be cut. The outline of the jig is held within the limits of the finished contour so as to provide clearance for the cutting jet and for the slag formed by the oxyacetylene cutting reaction. The material is placed upon these jigs by a labor gang, and removable stop keys are provided to definitely locate each stack of material without any adjustment after it has been piled.

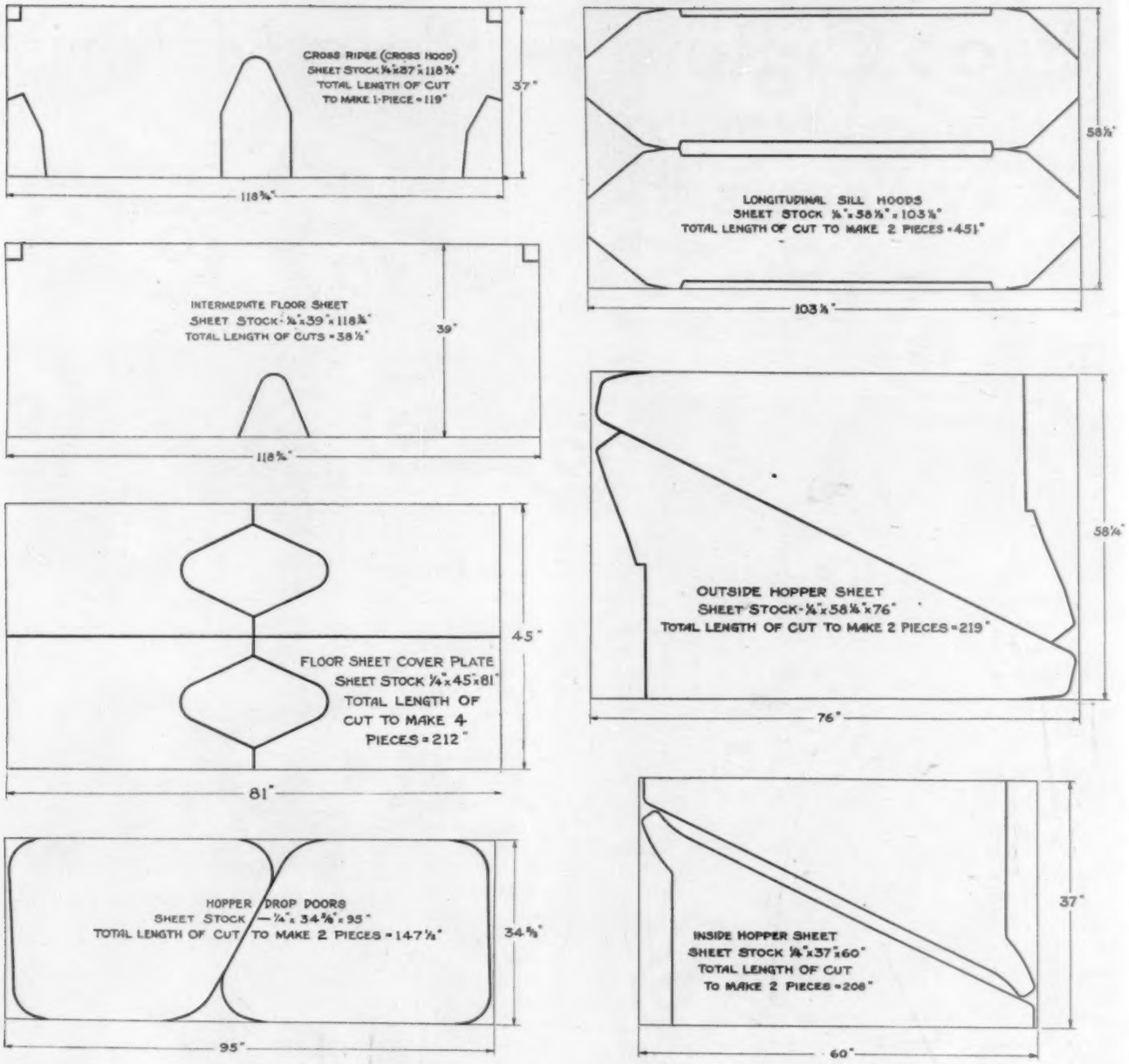


Cutting the Edge of the Cross Ridge Sheet.
(See next page for outline of sheet. Note the use of the hand toggle clamp.)

The stop keys are held in place in slots permanently welded to the channel beams. Provision has been made to work various sizes of plate stock from the same keyways or slots by making offset keys either extending beyond or receding from the vertical edge of the keyways. All the keys or stops are identified by markings indicating the specific operation on which they are to be used and the location of the stop slot in which they are to be placed. Thus a change of stop arrangement can be made rapidly, with no delay in the loading operation.

### Labor Gang Loads the Plates and Unloads the Cut Material

The labor gang for loading the plate material consists of two men who also have the duties of assisting with the unloading of the cut material by overhead




**Typical Parts Cut From Stacks of Sheets. The Heavy Lines Show the Cut Edges.**

crane and separating the cut sheet sections for subsequent handling by punch operators.

This labor gang loads the sheets onto the jigs from conveniently located stock piles. The sheets are loaded one at a time to allow a visual inspection of the surface condition and cleaning the surface of any matter that might prevent bringing the sheets in close contact for the cutting operation. Sheets or plates having kinked or buckled edges are straightened before being placed in the stacks to avoid separation of the material while cutting. This preliminary preparation has a very definite value as, by careful loading, a good, clean cut is obtained without any interruption.

The sheets are loaded twelve high where material ¼-in. thick is used, the stack thickness being nominally 3 in. This thickness of stack was considered to be the most economical after a study during which all factors of time and cost were considered. With a number of different sheet sizes and with variations in the lengths of cuts to form the various parts, it was found to be most economical to load 12 sheets in order that the loading gang could load progressively ahead of the cutting operation and no delay to the cutting operation would occur.

The material is loaded progressively—that is, the jigs are filled starting at one end of the machine and proceeding to the jig at the opposite end. The loading of the jigs continues, as does the unloading of them, while the cutting operation is being performed, and the entire operation becomes a complete cycle of loading, cutting and unloading.

As soon as it is possible to do so, the cut stacks are separated by the same labor gang, who make certain that there is no adhesion between the cut sections so that they can be easily handled through the subsequent fabricating operations. One might expect that the heat of the cutting reaction would fuse the edges of the sheets together, but that is not the case. With certain improvements made in cutting-nozzle performance, the operation of separating the cut sheets has nearly resolved itself into one of inspection in which it is only necessary to slide the sheets apart to make certain there is no adherence.

## Air-Operated Clamps Press Sheets Tightly Together

To insure close contact between the sheets, pneumatic clamping devices have been designed in which pressure can be applied quickly along the line of the cut. The pressure is applied through

levers moved by fulcrum bars extending along the sides of the work supports. The prime movers are 10 x 12-in. brake cylinders operated from the shop compressed-air supply at a pressure of 90 lb. per sq. in. The pressure levers or bars are so designed that they can be easily removed to permit unloading and loading. The labor of removing and applying them is performed by the labor gang.

The operator inspects the stack in order to assure himself that the preparatory work has been properly performed and that a good cut will result, after which he applies the clamping pressure. With the pneumatically operated clamps, the pressure is applied quickly and uniformly and the stacks are securely held against the jig forms.

## Only One Man Is Required to Operate the Cutting Machine

The cutting operation is started immediately after the clamping operation is completed, a single operator handling the machine. The driving mechanism is controlled from the torch end of the mechine through a lifting and revolving device. The feed or cutting speed is regulated at the motor through a governor setting and, as a constant speed is used for the 3-in. stacks, very little regulation of motor speed is required. With the lifting device, the machine can be moved from template to template from the front, or torch end, of the machine and there is no need for the operator to move from the normal line of operation to perform this work.

The cut is started at the edge of the stack against the gauging stops and, if continuous, is not interrupted until the cut is completed. In cases where the lines of cut intersect and stop at the point of intersection, gates or switches are provided in the templates, and when the cut reaches the point of intersection it is stopped until the gate can be moved into the proper position. The cut is then resumed by starting through the kerf at the point of intersection of the two lines of cut.

The speed of the machine is so regulated as to give a smooth cut with high economy of gases. In determining the proper size of stack to be used to obtain the best and most economical results a great deal of study was devoted to the size of nozzle, oxygen operating pressure, and speed of cut, as well as to the loading factor. A stack of 12 plates of ¼-in. thickness not only gives the greatest economy but permits using a medium-sized cutting nozzle at nearly top speed.

## Torch Cutting Shows Savings Over Shearing Methods

The results obtained have fully met the expectations. Cost records, carefully kept ever since the cutting machine has entered into full production, show an average saving over a 14-day period of 16% in the direct cost as against doing this work by shearing methods. This comparison does not consider any factors of overhead such as maintenance of shearing machines and blades nor power costs, nor does it include the saving effected by reducing the many handlings of this class of material which would be required with shearing.

It is evident, too, that the saving in direct cost will increase as better schedules are worked out for supplying the sheet material to the machine and unloading the finished work.

Another important factor is the large saving or earning obtained from the recovery of material. With shearing and coping methods, it is not possible to recover much of the offal removed from the sheets in pieces large enough for use in the manufacture of the smaller parts required in car construction. This is particularly true where recesses are sheared by means of a coping shear, as the material is removed in small bits which go into the scrap bins. The material removed from recesses by the flame-cutting process is in one piece and of such size as can be used for the manufacture of other parts. It is not possible to set up an average figure to represent this saving owing to the variation in the work, but it is recorded that usable material to the value of nearly $200 has been recovered during a 6-work-day period at our shop.

A comparison of the quality or workmanship obtained by shearing and by cutting with the flame-cutting machine is of interest. When the sheets are cut in stacks by the cutting machine, every piece is identical in contour and this contour can be duplicated over and over. This condition is, of course, not possible when the contour is sheared, owing to the manner in which the layout is made and the chance that slippage will occur under the shearing action.

With the sheets cut by the oxyacetylene process it is only necessary to adjust the gauging stops on the pressing dies once, while it is necessary to make frequent adjustments to take care of the variations caused by shearing.

**Plates Ready for Stack Cutting.**

(The jigs in the foreground are for the inside hopper sheets; the stacked plates beyond, ready for cutting, are for the outside hopper sheets, and in the rear the cross ridge sheets are stacked ready for cutting.)

## Flame-Cut Sheets Have Advantages Over Sheared Material

The edges of the flame-cut sheets are square and full with no burrs or slivers such as are present on sheets pre-fabricated by shearing methods.

There is a total absence of tearing with the flame-cutting method, because the cutting operation does not leave any sharp corners that have high stress concentrations and that yield under the additional bending stress of the pressing dies. The radii left at such locations in the sheet contour tend to strengthen this section and provide additional material for the drawing action of the die.

The facts herewith presented, developed through considerable experience, have convinced us that the stack cutting of sheet or plate material by the oxyacetlyene process is a valuable development for the car shop.

**Completely Rebuilt Self-Clearing Hopper Car.**

(The accuracy of the shape-cutting operation permits the pressed plates to be placed easily into their exact position.)

## WELDING SECRETS

By CLARENCE E. FLYNN

I'd like to know that secret
For which the whole world gropes.
I'd like to know a method
For welding broken hopes.

I'd like to know some master
Of all the welder's arts,
From whom to learn the secret
Of welding broken hearts.

I'd like to know the hiding
Of all the needed schemes,
And formulae, and methods
For welding broken dreams.

## Recommends Standard Size for Arc-Welding Glasses

A size 2 x 4⅛ in. was adopted as standard for all helmet and shield electric-welding glasses by the Welding Division of the National Electrical Manufacturers Association at their meeting in Cleveland, O., on Oct. 22. Almost all those engaged in manufacturing and supplying such glasses have adopted this standard, which is a close compromise between the three dimensions in common use. Glasses built according to the NEMA standard will also fit in a 4¼-in. holder, or even in a 4-in. holder.

# Get "H. O. T." on Welding

By H. O. T. RIDLON

Well, here she is a brand New Year just plumb full of hope, with most of us full of vinegar and all that sort of thing about the things we will accomplish during this 1937. Perhaps we won't be everything we expect to be, but we can be a little better perhaps this time next year if we can keep before us the fact that life is a challenge—its laws stern and rigid. And beyond question also, that men must be true to prosper much.

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### Month to Month Forecast for 1937

*January—*

There'll be rumors of strikes in the automobile industry.

One of the Roosevelt boys will be arrested for speeding.

We'll get income tax blanks from Uncle Sam.

It will be reported that Madrid will be captured most any day. By whom?

Something new will happen in the welding industry. Your guess is as good as mine.

*February—*

It will be reported that the strike in the automobile industry will soon be settled.

There will be plenty of snow and cold weather, and us lugs who live in the North will wish we were rich so that we could lay about the hot sands of Florida and watch the bathing beauties, instead of thawing out frozen water pipes.

F. D. R. will make a radio address.

Congress will start talking about going home.

The PWA will ask for billions more while everyone who has a job is talking about how good business is and how hard it is to find people to fill jobs.

*March—*

The welding conferences held in the universities this month will have a record attendance.

The automobile industry strike will be settled, and both sides will have claimed victory. But if the truth were spoken both sides will find they have lost.

It will be reported that one of the Roosevelt boys was stopped for speeding. And that the poor cop after much conversation claimed to be Eddie Windsor.

There'll be talk of bigger floods than last year.

Arthur D'Espies will return from his vacation in **Florida.**

*April—*

It will be rumored that Wally and Eddie had a spat.

Some lug will start claiming he can weld any piece of cast iron by the oxy-acetylene method without preheating.

We will—some of us—start playing golf and talking about the fishing we are going to do this summer.

Reports will come in from all over the country of the improved conditions in the welding industry.

*May—*

Many first cases of sunburn will be seen and reported.

Some shop owners will start regretting they did not talk hard-surfacing of plow shares to the customers way back in January, like their competitor did.

The good wife will start talking about where we'll spend the vacation. My vote will be that we pass it and spend nothing.

It will be reported that China and Japan are about ready to jump at each other's throats.

*June—*

Wally Churr will go fishing.

It will be rumored that there soon will be announced an improvement in arc welders.

Salesmen will start having trouble finding their customers in when they call.

Harry Parker will make a hole in one.

The oxygen and acetylene manufacturers will report that it is beginning to look like the first six months of 1937 are to be the largest in their history.

*July—*

It will be reported that two of the smaller oxygen companies are about to consolidate.

Someone will tell me about a new electrode holder that is better than anything yet. After seeing it I'll stick to my old favorite. Don't ask me what it is.

My boss will go away for a two weeks' vacation and be back on the job in three or four days after leaving the office.

It will be hot everywhere and farmers will begin talking about the long dry spell ruining their crops.

*August—*

Farmers will start talking about their crops being ruined by too much rain.

I'll start wondering if business will let up enough for me to take a vacation. So will you.

There'll be talk about strikes in the steel industry.

Gasoline prices will advance.

One of the Roosevelt boys will be arrested for speeding.

There'll be talk about Jim Farley resigning his cabinet post.

Jimmy Dawes will mail out his usual annual postal card picturing a fish bigger than he ever saw.

*September—*

There'll be talk about bronze-welding-rod prices advancing.

There will be rumors of bigger and better conventions next month.

F. D. R. will make another radio address.

*October—*

There will be a convention in Atlantic City of the American Welding Society and American Society for Metals which, as usual, will be worth while attending by everyone in the welding industry.

*November—*

The International Acetylene Association will meet as usual; Hank Booth will be elected Treasurer and Chairman of the Membership Committee.

There will be rumors of improvement in oxyacetylene welding equipment to be announced.

*December—*

I will be wishing you all a Merry Christmas and a Happy New Year. I will also be wondering how I will get a "thought for the month" each month and what I am going to do for the next year.

One of the Roosevelt boys will be arrested for speeding.

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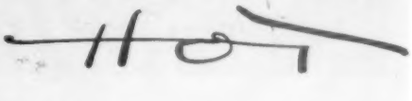
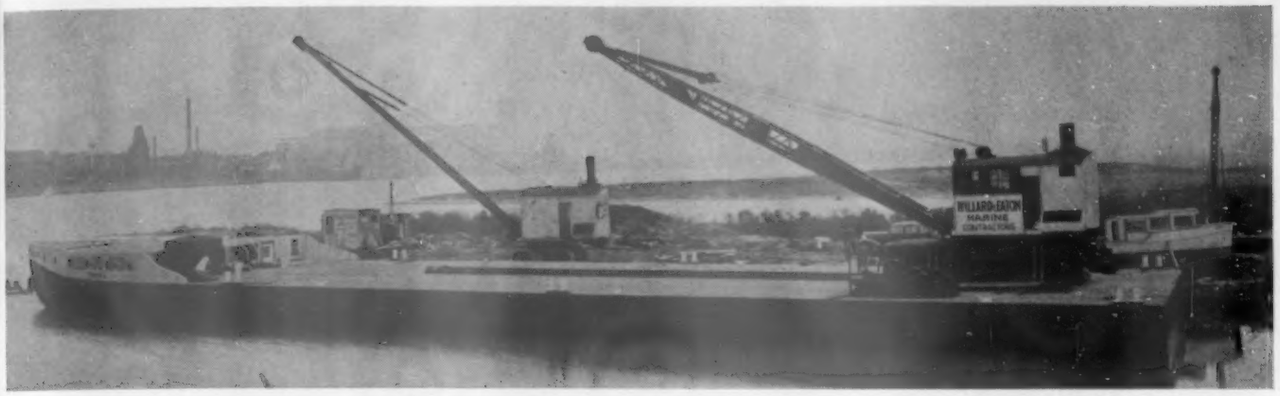
### A Hot Spark

If you think you need help and can't get it, just take time to help someone else and you will feel better for doing it.





This Derrick Scow, 175 Ft. Long, Is Half a Freighter Hull Rebuilt by Arc Welding.

## Large Derrick Scow Is Built From Old Hull

By A. F. DAVIS
Vice-President, The Lincoln Electric Co.

A 600-ton derrick scow, 175 ft. long with a 45-ft. beam, and 8½-ft. depth from deck to keel, reported to be the largest of its type on the Great Lakes, was recently completed by Willard & Eaton, marine contractors, Toledo, Ohio.

The new vessel was built from the hull of a freighter that was severely damaged, particularly from the boiler room aft, from having run aground. The wrecked hull was towed to Toledo and placed in an improvised drydock made by dredging a slip, sinking a scow across one end, filling the scow with dirt to block the end of the slip, and then pumping out the water. In this dry dock the hull was cut in two with oxy-acetylene torches, and engine room, boiler room, etc. were completely dismantled. The hull was stripped down to the tank top, leaving the bottom and approximately 5 ft. of the side plates.

All the work of building the vessel was done by the shielded-arc process of welding, approximately 3 tons of electrodes being used.

Every seam of the deck plating was welded to assure watertightness. Rivet heads were melted down by the carbon arc, permitting considerable saving over heading the rivets by the usual method of bucking and driving with a riveting gun.

Living quarters for the crew are provided in a forecastle, including seven staterooms, a galley and mess quarters, all erected by welding. The top of the forecastle is only 40 in. above the deck.

A 40-ton locomotive crane is carried on a runway and substructure fabricated from salvaged railroad craneways by arc welding. The crane travels along the deck and is used for dredging, moving material or lightering.

The scow is used as a floating repair shop for work on bridges and docks and for dredging. It draws only 3 ft. of water.

In addition to building this vessel by arc welding, the builder reports that an arc-welding machine will be carried in the hold of the scow to take care of general maintenance work on the craft itself and for repairing broken and worn parts of mechanical equipment.

## Uses Dry Ice to Purge and Test Gasoline Tanks

Before making a weld in any gasoline tank, Charles G. Eckhold, proprietor of the Best Welding Co., 6515 Page Blvd., St. Louis, Mo., uses carbon-dioxide gas to purge the tank so combustion will not occur from the welding heat. Instead of using the free gas, however, Eckhold employs dry ice (solid carbon dioxide), which gives off the gas during the process of evaporation. One pound of dry ice is equivalent to 8½ cu. ft. of free gas, but Eckhold uses twice this amount.

After the repair is made, there is still some of the dry ice remaining in the tank, so the tank is capped and soap water applied to the exterior to test for leaks. It is important, Eckhold says, to uncap the tank immediately after the test is made, because of the increasing pressure generated within the container by the evaporating dry ice. His customers are willing to pay him additional for this testing service, he says.

## St. Louis School Offers Course in Pipe Welding

Arc welding of pipe is being taught, with particular attention given to code requirements, in a school at 725 Choteau Ave., St. Louis, Mo., recently opened by B. H. Leonard, who has had extensive experience in refinery work and in shop production of pipe assemblies.

The standard course consists of 325 hours. Both day and night courses are given, the night course consisting of nine months, three nights a week and three hours a night. At the completion of this

Old Freighter Hull in Improvised Drydock.

Rebuilt Hull Will Be Used as Floating Repair Shop.

training, each student is expected to be able to make a qualifying weld in the downhand position. Training is given on pipe sizes from 2 to 24 in. in diameter, both standard and extra-heavy, with beveled ends. The pipe is spaced and tack welded in accordance with the pipe-fabricating codes.

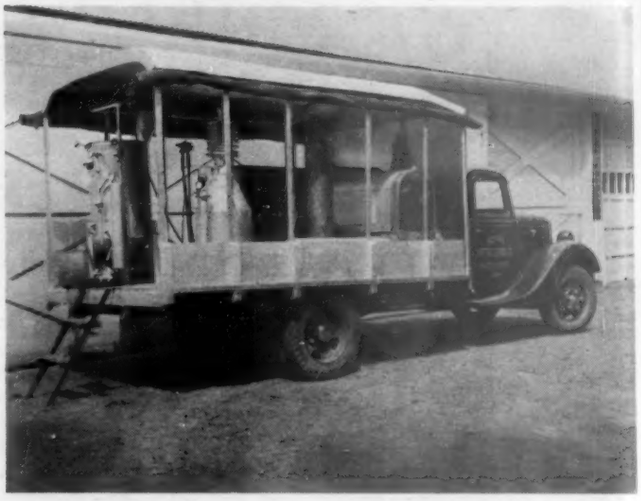
Although at present only arc welding is being taught, Mr. Leonard states that the installing of gas-welding equipment is under consideration.

## Portable Outfits for Metal Spraying Find Wide Use

Portable outfits for doing metal spraying in field operations are shown in the illustrations. Those engaged in metal spraying often find a wide variety of field work requiring quick transportation to the job, and the equipment must be such as to insure a high degree of reliability. All illustrations were supplied by W. C. Reid, of the Metallizing Engineering Co., Inc., Chicago, Ill., and some of them show equipment used in Mexican oil-field operations, while the unit owned by the Iowa Metallizing Co. has been used for lining tanks and vessels, railroad bridges, culverts, etc. with non-corrosive metals such as zinc and aluminum, and the Libby Welding Co. unit has been useful for out-of-town jobs, including the lining of water towers, water tanks, and other structures.

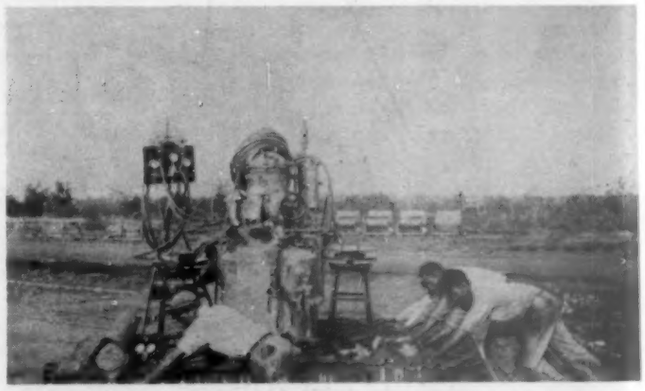
**"Metallizing" Unit Built and Operated by the Libby Welding Co., Kansas City, Mo.**

(Equipped with air compressor, sandblast machine, and complete metal-spraying equipment.)



**This Portable Unit Is Owned by the Iowa Metallizing Co., Pocahontas, Ia.**

(Consists of air compressor, sandblast machine, complete "metallizing" unit, acetylene generator, and oxygen cylinders, also equipped for welding and cutting.)



**Metal-Spraying, Welding and Cutting Equipment Mounted on Flat Car for Maintenance Work in Mexican Oil Field.**

(Equipment consists of two complete "Metallizers" with accessories, remote control panel for operation of "Metallizers" in positions remote from the flat car, acetylene generator, oxygen cylinders, and welding and cutting torches.)

**Improvised Steel-Grit Blasting Rooms Made From Discarded Oil Tanks.**

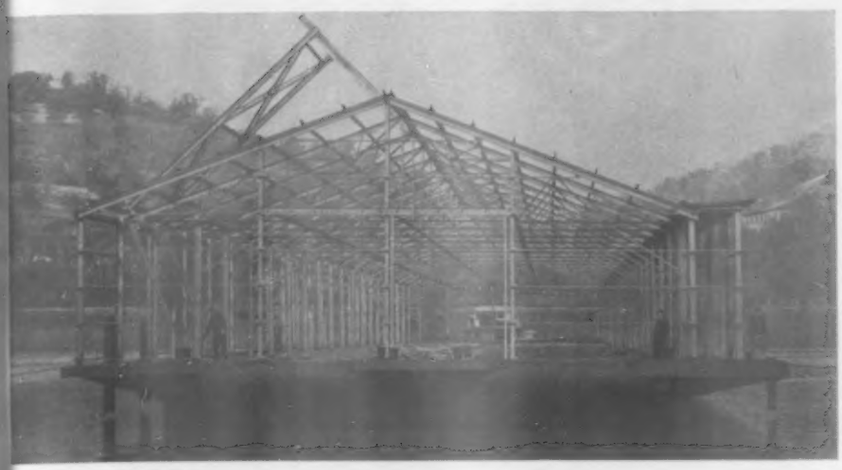
(At the top is shown a crude, temporary affair with a doorway cut out, and a fixture for a light welded to the roof. The bottom view shows a permanent set-up for oil-field operations, with a ventilator in the top, sliding grit-proof door, work bench and lighting system; the entire affair was made in less than 8 hours, using the portable unit on a flat car, shown in another view, and nothing but scrap material.)

## Wharf Boat Made From Six Salvaged Barges

Welding made possible the construction of the largest wharf boat now afloat on inland waterways, which was recently completed by the Dravo Corp., of Pittsburgh, Pa., at their Neville Island marine ways, for the Greene Line Steamers, Cincinnati, O. In its construction, six old sand and gravel barges were salvaged and, by means of arc welding, they were joined end to end and side to side to form a "pontoon" type of hull with a continuous deck.

The accompanying illustrations show interesting phases during the process of construction. The deck area is 76 x 348½ ft., while the hull dimensions are 56 x 7½ x 348½ ft.

This boat, it is reported, will serve as a freight and produce terminal at Cin-



Welded Wharf Boat, Built From Old Barges With Superstructure Added, Will Serve as Freight and Produce Terminal.

cinnati. It is so constructed that trucks and trailers can drive right onto the deck to load or unload.

Welding, and only welding, made this wharf boat assembly possible.

## Advanced Welding Course for New York Engineers

Engineers, designers, architects, production managers, welding supervisors, foremen and operators, and others interested in welding in and around New York City, will have an opportunity of obtaining advaneed instruction in the practical and theoretical aspects of arc welding the first week of February. This opportunity is offered by a special course in arc-welding design and practice sponsored by The Lincoln Electric Co., Cleveland, Ohio. The course will begin Monday, Feb. 1, and will last through Friday, Feb. 5. Meetings will be held in the Port of New York Authority Building, 15th St. and 8th Ave. The course will be under the direction of E. W. P. Smith, nationally known welding authority, and a small fee will be charged.

The course will consist of day and evening sessions. Mornings will be devoted to a consideration of welding problems. Practical welding demonstrations will be given in the afternoons. Evening sessions will consist of illustrated lectures and open discussions.

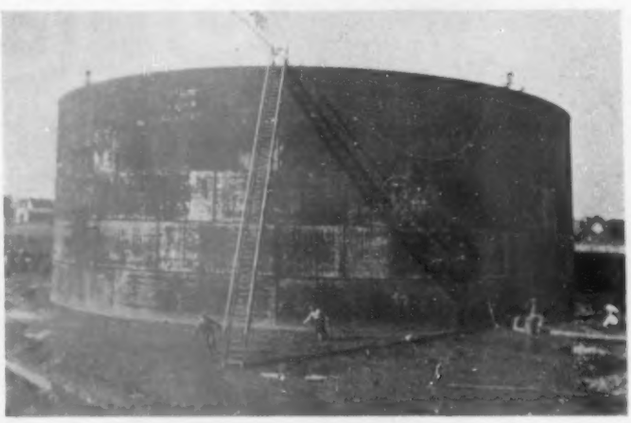
The purpose of the course is to study the arc-welding process and its application to design and fabricating problems. The process will be considered from the arc to the finished product. The following subjects will be covered: The shielded arc, its value and use in design; weld inspection; checking fusion and penetration; calculating stress distribution in welded joints; use of rubber weld models and polarized light in studying stress distribution; a practical metallurgical study of the welding of ferrous and nonferrous metals; determining the most economical section in changing from cast to arc-welded construction; organizing the welding department; and estimating welding costs. Characteristics of the welding arc will be illustrated by projecting the arc on a screen with a generator in operation, thus demonstrating the behavior of the arc in a variety of applications.

Complete information regarding the course can be obtained either from the New York office of The Lincoln Electric Co., at 330 West 42nd St., or from the Welding Engineering Dept., The Lincoln Electric Co., Cleveland, Ohio.

## Welded Oil-Storage Tanks for New Jersey Firm

Three 80,000-barrel oil-storage tanks are being erected at Carteret, N. J., for the General American Storage & Terminal Co., Inc., of that city. These tanks, all the seams of which are butt welded, are 117 ft. in diameter and 42 ft. high. Each tank required 283 tons of steel plates and shapes. Fabrication was done at the Sparrows Point, Md., plant of the Bethlehem Steel Corp. and the assemblies were shipped to Carteret for erection, where two crews of eight welders each have been employed in alternate shifts on the construction.

Welding Side Plates.



80,000-Barrel Tank With Butt-Welded Plates.

# What's New in Equipment and Supplies

## New A. C. Electrode for Transformer-Type Welders

The Wilson No. 520 electrode, designed for use with small transformer-type a.c. arc welders, has been announced by the Wilson Welder & Metals Co., 60 East 42nd St., New York, N. Y. Striking and maintaining an arc without difficulty is an actual accomplishment with this new electrode, and it is claimed that operators find it exceptionally easy to handle, and that it works equally well with a.c. or d.c. machines. Good-looking bead deposits are the result, and slag interference is reduced to the minimum with removal simplified.

## Transformer Welder Can Use Variety of Rods

A new Donganarc a.c. welder, said to operate satisfactorily with any one of many different makes of coated rods, has been announced. This welder is equipped with a special type of reactor which tends to stabilize the current flow and to maintain the arc under all conditions.

There are no exposed switches. The secondary-current output is handled by a series of specially designed push-and-pull switch controls. All switches are fully concealed so that there is no danger of damage to the machine or of injury to the operator, resulting from accidental contact with live parts. The switches provide a wide range of precise heat adjustments, controllable in steps of 10 amperes; except in the smallest model, which is controllable in steps of 5 amperes.

The Donganarc welder is marketed through the Donganarc Sales Co., Detroit, Mich. It is available in four sizes —100, 200, 300 and 400 amperes capacity. The arc stabilizer—a high-frequency generator with which uncoated rod may be used—can be furnished as an accessory.

New Donganarc A. C. Welder.

## Light-Weight Torch With Automatic Gas Shut-Off

The Weldit Automatic Welding Torch has been brought out in a new model—Model W—which weighs only 13 oz., and is designed with a special gas-tight swivel which enables the operator to weld in any direction without changing the angle of the torch handle. It automatically shuts off to a pilot light when not in use, and automatically comes back to full flame when the operator is again ready to weld—without the need of further readjustment.

Torch Weighs Only 13 Ounces.

This new model has no mechanism inside the handle; and its small fuel-control valves are placed at the front end of handle, where they can conveniently and easily be adjusted. Another feature is a special replaceable tip nut at the end of the extension, which eliminates the necessity of replacing the entire extension should the threads in the tip nut become worn.

The torch is manufactured by the Weldit Acetylene Co., Detroit, Mich.

## New Development in Abrasive Masks

A new type of abrasive mask has been announced by the Mine Safety Appliances Co., Pittsburgh, Pa. It is a light-weight unit, said to be capable of giving complete protection to the wearer from the heavy concentrations of fine dust present in shot- and sand-blasting rooms. It is sturdily constructed and able to withstand the impact of high-velocity abrasives, and its protective efficiency and durability have been thoroughly tested and proved by many months of severe service.

Air is fed into the face-piece through a corrugated rubber tube which permits free movement of the head. The incoming air enters the lower part of the face-piece and passes out through double exhalation valves, whose extremely low resistance to the air flow permits low pressure in the face-piece and assures an ample supply of air.

A latex-covered silk hood, very light in weight, tough and resilient to the high-velocity impact of the abrasive particles, fits neatly over the head and shoulders of the operator and fastens at his waist, exposing only the lens section of the face-piece.

Mask Gives Protection When Sand-Blasting.

The air passing out the exhalation valves from the mask serves to inflate the hood slightly, providing an air-cushioning effect which increases the natural resistance of the fabric to the wearing action of the shot or sand. The hood is removable and replaceable, being attached to the face-piece with readily opened fasteners.

The mask has a flow-control valve with a "bump-proof" adjustment. The setting cannot be changed accidentally, since the handle is normally held in a release or "free-wheeling" position by means of a spring which must be pushed in by the operator to an "engaged" position and then turned to change the flow of air.

In the event the air supply should fail, or become unusable for any reason, a lever extending over the air-supply nipple of the flow-control valve immediately detaches the mask from the air line when pulled upward by the operator. This enables the operator to break his connection and breathe through the filter on the free end of the corrugated tube, and leave the confined space.

If desired, a replaceable charcoal cartridge filter can be provided to remove objectionable odors and foreign matter, such as dirt and oil, from the incoming air for the further protection of the operator.

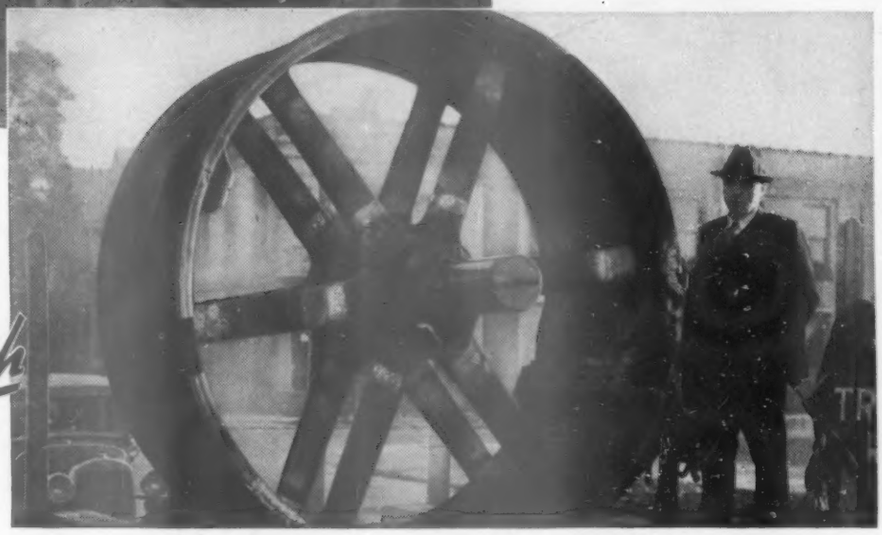
## Oil-Burning Torch for Preheating

Hauck Fire Gun No. 250 is announced by the Hauck Manufacturing Co., 126-134 Tenth St., Brooklyn, N. Y., for general preheating purposes in welding, as well as thawing, disinfecting, weed burning and many other uses.

This fire gun, which burns kerosene, range oil or light furnace oil, weighs 14 lb. net, can be carried slung from the shoulder, and produces a flame temperature of 2,000° F., with a reddish-blue

*In pieces October 6th*

*Back on the job October 12th*



# THANKS TO TOBIN BRONZE!

THE whole town of Austin, Pa., depends upon this pulley for food. It turns the wheels of The Bayless Pulp & Paper Company's mill and most everybody in Austin works for Bayless.

Recently, the shaft to this 84" pulley snapped between the two sets of wheel spokes, breaking all twelve spokes away from the hub and all but three away from the rim.

The plant was paralyzed . . . delivery of a new wheel would take from four to six weeks! Some one suggested welding. The idea seemed fantastic but the Bayless Company went to Hebeler Welding Company, of Buffalo.

The pulley was rushed to Buffalo, repaired with Tobin Bronze, sent back and re-installed —all within six days. Weeks of disastrous shut-down were averted and the cost of a new casting saved.

When difficult welding jobs appear, nothing equals Tobin Bronze! This time-tried Anaconda product carries the trade-mark "Tobin Bronze Reg. U.S. Pat. Off." on each rod. Look for this mark and be sure you're getting genuine Tobin Bronze.

ANACONDA
from mine to consumer
BRASS

## Anaconda Welding Rods

THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Connecticut

*Offices and Agencies in Principal Cities* • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

Oil-Burning Torch in Operation.

flame 3 in. in diameter and 30 in. long. The manufacturers declare this gun operates well in any kind of weather and consumes but 1 gallon of oil per hour. The gun has shown particular usefulness, it is declared, in preheating for welding rail ends.

## Three New Regulators of High Precision

A series of three new regulators, said to provide accurate oxygen and acetylene regulation through the entire range of welding and cutting operations, has been announced by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. All three regulators are of two-stage construction and essentially identical in basic design.

The Oxweld Type R-64 oxygen regulator is designed to operate with extreme precision in all welding and cutting operations requiring oxygen pressures up to 75 lb. per sq. in. The Oxweld Type R-65 oxygen regulator is intended for heavy-duty cutting operations, which may require oxygen pressures as high as 200 lb. per sq. in., but its sensitivity of adjustment and precision of operation make it adaptable also for welding operations. The Oxweld Type R-66 acetylene regulator is a companion piece for either of the oxygen regulators and is said to give accurate acetylene regulation for all welding and cutting operations.

In addition to the attractive, streamlined appearance of these regulators, there are also several outstanding details of interior design. The valves are stem-operated and close with the incoming pressure, not against it, and sensitive rubber diaphragms and self-contained first-stage valves are employed. The bodies and caps are pressure forged to insure adequate strength. The dials of the pressure gauges are colored and the calibrations are silvered, thus making them very easy to read. Also the point of the pressure-adjusting screw is cradled in three ball bearings to preserve exact alignment and provide easy manipulation.

Regulators of Streamline Design.

## New Electrode Makes Welds of 100,000-Lb. Strength

Welds with tensile strengths of approximately 100,000 lb. per sq. in. are claimed for a "Shield-Arc 100" electrode just announced by The Lincoln Electric Co., Cleveland, O. This is a heavily coated electrode of the shielded-arc type, for welding steels having somewhat higher ultimate strengths than those ordinarily welded with "Shield-Arc 85" electrodes.

Welds produced by the new electrode in the higher-tensile steels possess ultimate strengths of 100,000 to 105,000 lb. per sq. in. in the as-welded condition, it is claimed, with ductility of 12% to 18% elongation in 2 in. When deposited in mild-steel plate, the weld metal will have a tensile strength of approximately 100,000 lb. per sq. in., yield point of 85,000 to 95,000 lb. per sq. in., and ductility of 12% to 18% elongation in 2 in., in the as-welded condition. When stress-relieved, the welds possess an ultimate strength of 110,000 to 115,000 lb. per sq. in., yield point of 95,000 to 105,000 lb. per sq. in., and ductility of 18% to 22% elongation in 2 in.

The "Shield-Arc 100" electrode is suitable for flat, vertical and overhead welding and is available in diameters of 1/8, 5/32 and 3/16 in. For most vertical and overhead welding the 1/8 and 5/32 in. sizes are preferred. However, the 3/16 in. electrode may be used for making vertical welds in thick plate.

## Device for Adjusting Voltages to Proper Values

For the control or regulation of voltage in electric soldering and light welding operations, feeding from a.c. circuits, the new Type TH Transit voltage regulator has been placed on the market by the American Transformer Co., Newark, N. J. This device can be used to deliver an adjustable output voltage to electric equipment, or to compensate either high or low line voltages so as to permit equipment to operate at normal voltage under all conditions.

It is said to offer the same smooth control as obtained from a rheostat, plus the high efficiency, good regulation and great flexibility of a transformer. It is available in various sizes for controlling voltage to loads up to 2½ kw. on either 115- or 230-volt lines.

Not only will it give smooth control of voltage from practically zero to normal line potential, but it is also capable of stepping up the voltage to considerably higher than line voltage.

Regulator for Smooth Adjustment of Voltage.

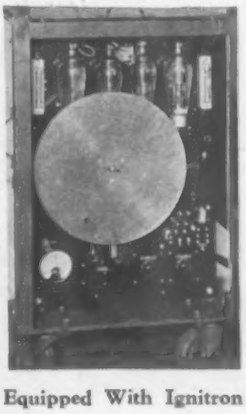
By connecting a number of these voltage regulators in combination, they can be used on higher voltages and for controlling 3-phase circuits. In a publication issued by the company, diagrams are used to illustrate 14 different ways in which these regulators can be connected in electric circuits.

## Accurate Timing Control for Seam Welders

A new seam-welder control utilizing Ignitron tubes has been announced by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This control times the power impulses in terms of a definite number of power cycles to a wheel-type electrode resistance-welding machine.

Among its features is an inductive timer, consisting of a synchronous-driven disc rotating once per second and containing 120 holes, each corresponding to a half cycle of welding current. Also the use of Ignitron tubes permits a design utilizing no voltages higher than line voltages and eliminates the need of power contactors and transformers. Steel pins are plugged into the holes according to the timing desired.

The new control is simple, durable and the timing is said to be precise. Its use makes possible the obtaining of high-quality welds, even in the very-light-gauge steels, it is claimed, and it is especially suitable for welding heavy-gauge steels demanding heavy welding currents, and special metal alloys de-



Timer Equipped With Ignitron Tubes.

manding accurate timing and often heavy currents, such as aluminum and olympic bronze.

## Light-Weight, Low-Priced Transformer-Type Welders

To supplement their line of portable arc welders, The Miller Electric Manufacturing Co., Appleton, Wis., has brought out a light-weight, low-priced transformer-type welder under the trade

Welder With Rotary-Knife-Switch Control.

name "Miller Standard Arc," in four models of capacities from 130 to 300 amperes.

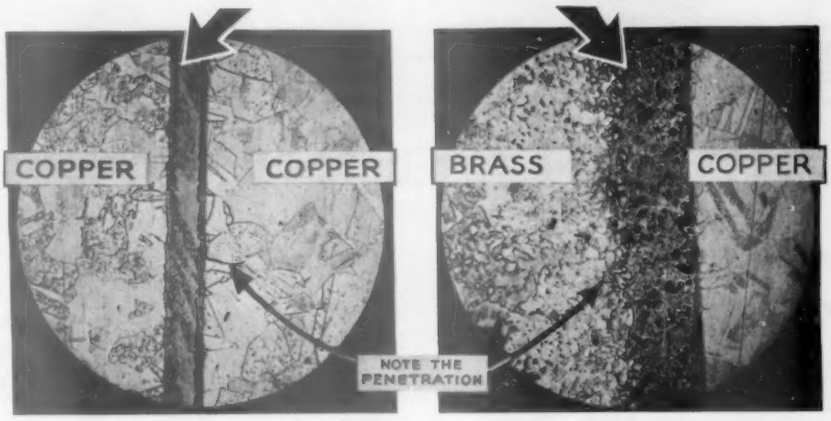
Equipped with rotary-knife-switch control with amperage marked for each welding step, these welders have the same efficiency as the regular Miller welders, the manufacturer states. They are lighter in weight only, because the cabinet is wood and there are fewer amperage controls than in the regular welders. Neither are they equipped with reactance control or sheet-metal attachment.

## New Product for Cleaning and Etching Metal

A new product for preparing metal before the paint finish is applied, has been announced by the Rusticide Products Co., Cleveland, O. The product, known as Rusticide "50" cleans and etches the metal, leaving a rust-proofed surface ideally conditioned for painting, it is claimed. It dissolves from the metal all foreign materials such as grease, oil, wax and surface oxidation. Deeply pitted rust can be removed instantly in the presence of Rusticide "50" with the aid of steel wool. This eliminates the necessity of sanding.

Shipped in concentrated form, the material is diluted with 2 to 3 parts of water. It may be applied with cloth, brush or spray gun and is removed either with dry cloth or dipping in water. The metal is ready to paint ten minutes after treatment and is protected from fresh oxidation for a period of several days. It is non-inflammable, non-explosive and non-toxic, the manufacturer says.


# For STRENGTH braze with Sil-Fos




*These photomicrographs tell why SIL-FOS joins non-ferrous metals permanently. Notice how the film of SIL-FOS actually alloys with the metals it joins to make a joint as strong as the metals themselves.*

In a SIL-FOS brazed joint you get high

**STRENGTH** coupled with ductility to withstand constant vibration . . . as well as shock.

**STRENGTH** that has the ability to withstand the heat of overloads . . .

**STRENGTH** which combined with a high degree of electrical conductivity and corrosion-resistance, is an assurance of efficient and durable construction.

**STRENGTH** not only in the joint but in the adjacent metal too—because, low temperature brazing makes it possible to avoid burning out the metals strength—it leaves physical qualities undamaged.

SIL-FOS flows freely at 1300° F.—far lower than base metal brazing or welding rods—it penetrates quickly to all parts of the joint. Low cost per pound plus the fact that it gives you the economy of less gases and less labor makes the cost per joint surprisingly low.

TRY SIL-FOS ON YOUR WORK

It may take a trouble-spot out of your production. It may show you the way to lower costs. Write for bulletin 51-W.

HANDY AND HARMAN
82 Fulton St., New York

# Trade Literature

A new catalog of 36 pages has been issued by the New Process Plow Welding Co., Perry, Iowa. It lists and describes reclaiming units for plow shares, lister shares, corn-planter runners, cultivator shovels and surface blades, also complete cultivator shovels and sweeps, as well as welding tables, disc grinders, transformer-type a.c. welding units, welding rods and electrodes, hard-surfacing alloys, welding and cutting torches, acetylene generators, brazing and welding flux, welding accessories, hacksaw blades, "Seep Seal" for castings, sheet-metal equipment, belt hooks, and grinding and polishing equipment.

"Victor" welding and cutting equipment is described and prices listed in an 80-page catalog published by the Victor Equipment Co., 844 Folsom St., San Francisco, Calif. In addition to a vast amount of data on torches and regulators, the catalog also gives information on underwater cutting torches, manifolds, acetylene generators, flux, accessories, gloves and goggles. A section is devoted to the company's manufacturing facilities, with particular attention to workmanship and inspection of parts.

A new catalog, No. R-120, issued by The Bastian-Blessing Co., 278 E. Ontario St., Chicago, Ill., announces a reduction in prices of "Rego" welding and cutting equipment. Besides torches and regulators, as well as complete outfits for welding, cutting soldering and brazing, the catalog also describes and lists prices on gas economizers, flux, lighters, tank trucks, hose connections and clamps, pressure gauges, acetylene generators, and goggles.

"New Profits in Job Welding" is the title of a 48-page booklet issued by Hobart Brothers, Box U-126, Troy, O., which gives information on the selection of equipment for job welding, training required, how to build up a business, how to set prices, and descriptions of various types of profitable jobs. Many kinds of jobs are illustrated, with cost information given in some cases.

Oster-Williams equipment, including a torch cutting machine for pipe intersections, pipe assembly welding bench, pipe welding clamp, threading equipment, and pipe cutters, are described and illustrated in a new catalog issued by The Oster Manufacturing Co., Cleveland, O.

"Lindewelding Pipe Lines" is the title of a 32-page illustrated booklet published by The Linde Air Products Co., 30 East 42nd St., New York, N. Y., dealing with economies and speeds obtained by this method of pipeline welding, as well as joint design, quality and strength of welds, simplicity of field operations, and other pertinent subjects. A list of oxyacetylene-welded lines laid since 1917 is included.

"Imperial" welding and cutting equipment is described and prices listed in a new catalog published by The Imperial Brass Manufacturing Co., 522 S. Racine Ave., Chicago, Ill. Descriptions are given of outfits for welding and cutting, torches, regulators, gauges, soldering and brazing outfits, blow torches for preheating and soldering, lead-burning outfits, hose and hose connections, gloves, goggles, lighters, flux, cylinder trucks, and welding rods and electrodes.

"MetaLayeR—Complete Metal Coating Process" is the title of a 6-page file folder, No. 1206, issued by the Metals Coating Co. of America, 495 N. Third St., Philadelphia, Pa. Photographs of typical sprayed molten metal coatings, both for maintenance and production, as well as a complete description of the process and equipment, are included.

Colmonoy No. 6, and its application as an overlay, using the oxyacetylene flame or carbon arc, is described in a booklet issued by the Colmonoy Co., Los Nietos, Calif. A number of applications are mentioned, and physical and chemical properties given. Also, properties are listed of alloys formed with copper.

"Railroad Uses for the MetaLayeR" is the title of a folder issued by the Metals Coating Co. of America, 495 N. Third St., Philadelphia, Pa., illustrating typical sprayed molten-metal coating operations for maintenance and production that have resulted in savings in the shop and in the yard. Many applications of the process are listed.

The "Shield-Arc SAE" welder, in sizes of 200, 300, 400 and 600 amperes, is described, and dimensions and specifications given, in two bulletins published by The Lincoln Electric Co., Cleveland, O. Bulletin No. 316 relates to the motor-driven models, and Bulletin 317 to the belted or direct-driven models.

How to reduce the cost of pipe work and make better piping jobs, is the story told in an 8-page pamphlet, which also describes the Douglass pipe-fitting machine for cutting and preparing pipe intersections for welding. Copies are available from The Douglass Pipe Machine Co., St. Joseph, Mich.

Industrial safety equipment of a wide variety is described and shown in a 128-page catalog, No. 5-B, issued by the Mine Safety Appliances Co., Pittsburgh, Pa. Another catalog by the same company, known as No. 5-A, was recently released, of particular interest to the mining industries.

The Tungar arc welder is described, with particular emphasis laid on its advantages for use with sheet metal, in bulletin GEA-2447B, published by the General Electric Co., Schenectady, N. Y. A number of installations are shown, as well as close-up views of welds.

"The Oxygen Lance" is the title of an illustrated pamphlet giving a great deal of detailed information on the operation of this device and its uses. The pamphlet is published by The Linde Air Products Co., 30 East 42nd St., New York, N. Y.

The new "Turret-Type" welding shield recently announced by the C. H. Dockson Co., 2885 E. Grand Blvd., Detroit, Mich., is described in a leaflet issued by this company. Economy, comfort, and sanitary design are emphasized.

Simple designs of connecting links and bearing supports, made from standard shapes and plates by welding, are outlined in Application Sheet No. 52 of Series 2, published by The Lincoln Electric Co., Cleveland, O.

# Commercial News

## Builds Demonstrator Truck With Power Take-Off

The truck illustrated herewith created a great deal of interest at the recent welding conference at Purdue University, Lafayette, Ind., because of its attractive appearance as well as the mounting and arrangement of equipment and supplies for carrying on demonstrations in welding. This new truck was built by the Sutton-Garten Co., 401 W. Vermont St., Indianapolis, Ind., and is being used by their representative in making demonstrations throughout Indiana.

The chassis and motor are from a 1933 Buick, 60 Model, Straight Eight. The

**Truck Especially Built for Welding Demonstrations.**

motor was dismantled and a 12-in. extension welded onto the crankshaft. After machining the crankshaft, it was reassembled in the motor and then put back into the frame. This extended crankshaft is the source of power for the power take-off, which consists of heavy 10-in. sheaves, with six $\frac{5}{8}$-in. V-type belts. The power for operating the welding generator is transmitted to a shaft mounted along the frame in self-aligning ball-bearing supports. This shaft extends 3 or 4 ft. behind the driver's seat.

The G-E arc welder, of 300-ampere capacity, is mounted behind the driver's seat and is attached to the drive shaft by means of a 10-in. sheave and six V-type belts, the same as used on the crankshaft.

A special clutch attached to the front part of the crankshaft controls the power take-off. The operation, or driving, of the truck itself is not changed, and when the welder is to be used the operator merely adjusts this clutch and tightens up a set screw, thereby making the power of the engine available for running the welder. A Pierce governor installed on the unit controls the speed of the motor when welding.

The truck body is entirely of steel, hammered out and welded. The body was built by the Indianapolis Power Hammer Works, of Indianapolis, Ind.

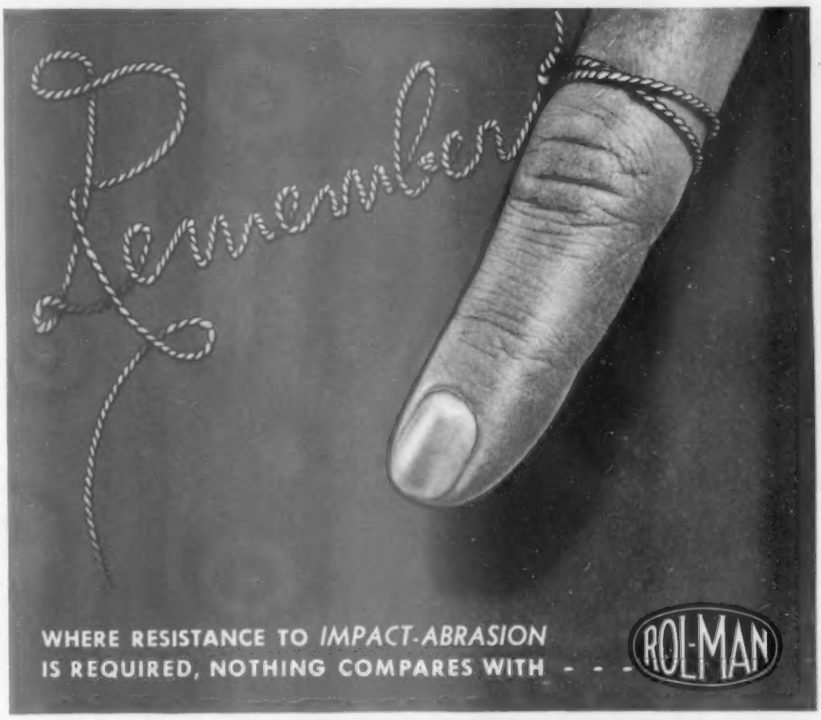
## Victor Promotes Blake to Vice-President

The Victor Equipment Co., San Francisco, Calif., announces the appointment of J. C. Blake as a vice-president of the company, in recognition of Mr. Blake's service as welding division manager of the Los Angeles district, during which he increased the company's business in southern California several fold. Mr. Blake's organization recently moved into the new Victor Building, an attractive structure located at 3821 Santa Fe Ave. in Los Angeles.

Prior to his connection with Victor, Mr. Blake was sales manager of the Stoody Co., Whittier, Calif. He is a graduate of the U. S. Navy school at Annapolis and is a lieutenant commander in the U. S. Navy Reserves.

**J. C. Blake, Victor's New Vice-President.**

The 24th annual meeting of the Compressed Gas Manufacturers' Association




"True" MANGANESE STEEL WELDING ROD

Tough-Hard, Strong, Ductile, Wear-Resisting Welds result with ROL-MAN, *The Pioneer Manganese Steel Welding Rod* . . . Purity of the uniformly dense, fine-grained *TRUE* (11% to 14%) MANGANESE STEEL, together with the special coating, insures a smooth free-flow and produces a *Clean, Even Weld, Without Checks or Cracks* . . . The coating definitely shields the arc during welding and excludes harmful inclusions of nitrogen and oxygen. Available in standard lengths and all diameters.

SEND FOR FREE SAMPLE AND CATALOG

MANGANESE STEEL FORGE CO., BUTLER & RICHMOND STS., PHILA., PA.

was held on Jan. 18 and 19 at the Waldorf-Astoria, New York City, with business sessions on Monday, the 18th, and technical meetings in both morning and afternoon on the 19th. The annual reception and banquet was scheduled for 6:30 p. m. on the 19th. At the luncheon on the 18th, Dr. John T. Madden, dean of the School of Commerce, Accounts and Finance, of New York University, outlined his conclusions regarding the effect of the European situation on this country's future economic policy. E. A. Faulhaber, of compressed Industrial Gases, Inc., Chicago, Ill., was elected president of the Association.

Yarov Bros., Inc., 5031 Liberty Ave., Pittsburgh, Pa., have opened a branch office at 712 Market St., Youngstown, O., in charge of Harry Yarov. A full line of welding and cutting equipment is handled at both offices. A complete service department was recently established at the Pittsburgh headquarters for the expert repair or rebuilding of torches, regulators and gauges. Yarov Brothers have been appointed by Compressed Industrial Gases, Inc., as distributors and warehousers for the automotive trade.

Compressed Industrial Gases, Inc., 221 N. La Salle St., Chicago, Ill., announce that they have absorbed their wholly owned subsidiaries, whose businesses will hereafter be transacted by the parent company under its own name. The subsidiary companies were: Burdett Oxygen & Hydrogen Co., Burdett Oxygen Co., Butler Gas Products Co., Mo-Ark Oxygen Co., Welders Supply Co., and Wisconsin Oxygen-Hydrogen Co. There is no change in personnel in these former subsidiaries. Compressed Industrial Gases are building a new plant at Shreveport, La., to supply oxygen and acetylene, and are opening a welding-supply store in Monroe, La.

Arcos Corporation, 401 N. Broad St., Philadelphia, Pa., is the name of a new company formed from the merging of Arcos, Inc., and R. S. Thomas & Co., both of which have been operated as one organization for six years under the management of R. D. Thomas as president of R. D. Thomas & Co. and vice-president of Arcos, Inc. Mr. Thomas is president of the new Arcos Corporation.

The American Chain & Cable Co., Inc., is the new name of the American Chain Co., Inc. The enlargement of the name was recently acted on by the company's board of directors, and the new name was adopted as being more appropriate for a company which has become a leader in the production of wire rope and cable as well as chains.

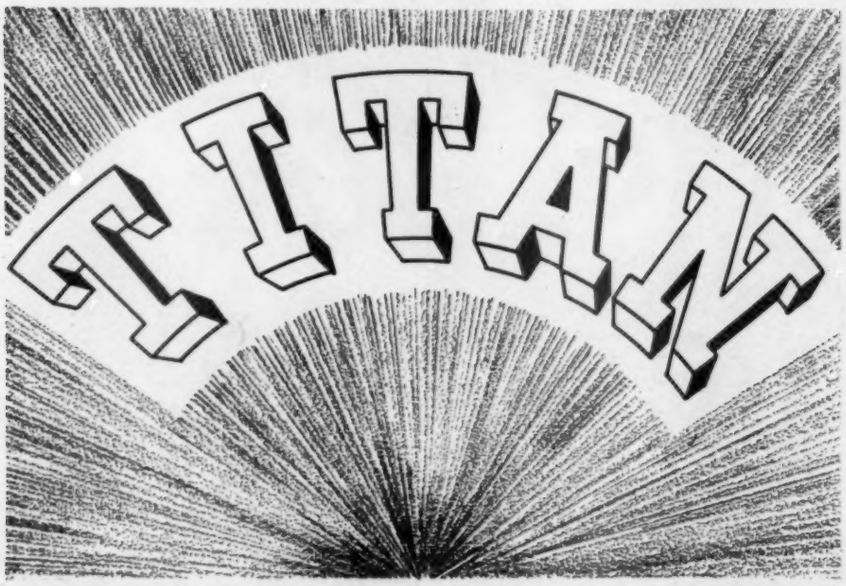
J. W. Wilkinson, manager of the Wilco Electric Welding Machine Co., Kansas City, Kan., died suddenly from a heart attack on Dec. 10. He had been actively engaged in the manufacture of a.c. arc welding machines for the past 15 years. The company will continue to operate under the management of G. M. Wilkinson.

Robert Notvest will terminate his connection of several years with the J. D. Adams Co., Indianapolis, Ind., on Feb. 1, and will conduct a consulting service on arc-welding problems, with headquarters at 457 S. Arlington, Indianapolis.

The Welding Service Co., 2402 Market St., Philadelphia, Pa., of which office John Land is manager, has been made a distributor for "Rego" welding and cutting equipment, manufactured by The Bastian-Blessing Co.

William F. Fischer has been appointed to the sales staff of the San Francisco office of The Lincoln Electric Co., located at 866 Folsom St.

The Lincoln Electric Co. has opened an office in Chattanooga, Tenn., at 1015 Hanover St., with Robert Daniels in charge.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## Titan Metal Manufacturing Co.

**Bellefonte, Pennsylvania**

# Notes From the Field

The Dravo Contracting Co., of Pittsburgh, Pa., one of the largest builders of welded floating equipment in the United States, will in the future operate under the name of the Dravo Corporation. The bulk of the welding specifications will now pass through the engineering works division which includes barges, tow boats, car floats, dredges and ferry boats, cranes, lighters, dump scows and material-handling installations as well as steel floating and terminal equipment. Other divisions of the company include the contracting and Keystone Sand Division. The Dravo-Doyle Co. will specialize in power plants, pumping, heating and air-conditioning equipment. The merging of the various subsidiary companies is in line with the general movement now so prevalent in the steel industry and is expected to result in increased efficiency and economy in operation.

---

The Marietta Manufacturing Co., of Point Pleasant, W. Va., have several large welding jobs under way at the present time, at their marine ways on the Monongahela River. Bottom plates have been laid for another modern stern-wheel steamer which is being constructed for the Standard Oil Co. of Louisiana. The hull will be of the all-welded type with a cabin of wood. This boat, which has not yet been named, is expected to be launched in the spring. Work on the *Opon*, another stern-wheel steamer, is progressing rapidly and this boat will be launched late in January. The *Opon* is being built for the Tropical Oil Co. of Canada and when completed will proceed under its own power to New Orleans, where preparations will be made to take it across the Gulf for delivery to the Magdalena River, where it will be placed in the trade.

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A large cast-iron welding job worthy of mention was recently completed by the Coralena Oil Co., Russell, Kan. A broken water jacket, fractured two-thirds of the way around the cylinders, on a large diesel engine used as power for a rotary drilling rig caused a costly shut-down. Because the job could be very satisfactorily repaired by arc welding without having to dismantle the engine, it was decided to use that process. The heavy castings were steel studded, and welded up in good time, causing the company a minimum delay.

---

The building up of a shaft for the Cahokia, Ill., plant of the Union Electric Light & Power Co. was recently completed by the Charles G. Kruckemeyer Machine & Parts Co., 6100 Minerva Ave., St. Louis, Mo. The shaft, 12 ft. in length and 5 in. in diameter, contained spiral flights 4 in. apart. A hard-facing metal was applied to both sides of the flights and to the exterior of the shaft proper, by means of the electric arc, after which the shaft was ground down to its correct measurements. Charles G. Kruckemeyer, head of the company doing the repair work, says that draftsmen are increasingly specifying the welding of parts that formerly were bolted or riveted.

---

After several months' interruption, the Defiance Pressed Steel Co. has resumed manufacturing operations in their new plant at Marion, O. Their long record of 66 years continuous operation was suddenly interrupted last June when a $1,000,000 fire lowered to the ground their plant then operating in Defiance, O. The new plant comprises the buildings formerly occupied by The Power Manufacturing Co., of Marion, which have been renovated and rehabilitated. The company specializes in metal stampings and welded assemblies. The plant


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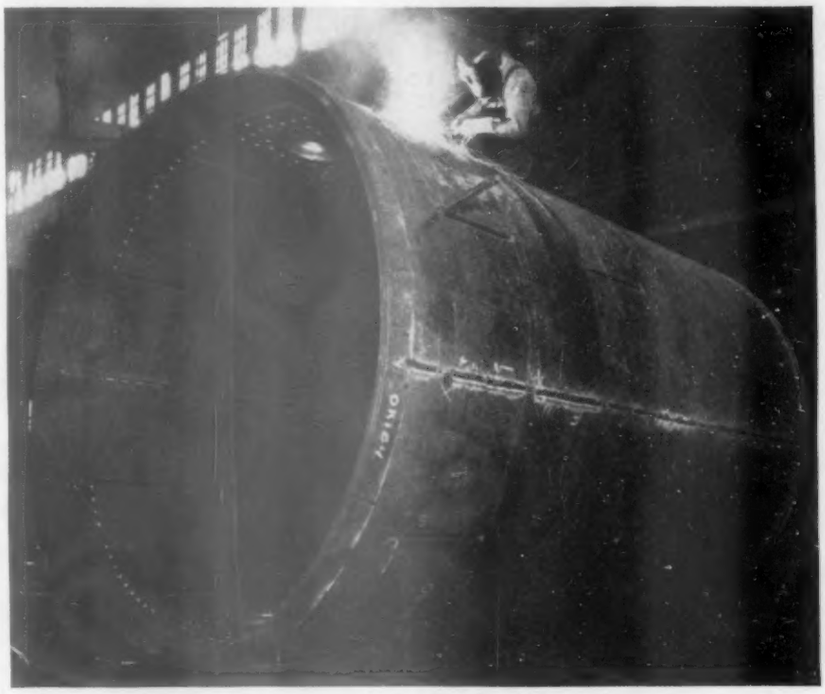
RYERSON NO. 215 AND NO. 216 ELECTRODES



*Ryerson No. 215 and No. 216 used to weld World's largest welded ladle.*

● The partly fabricated ladle shown above, is one of six welded ladles built by John Mohr and Sons, Chicago, Ill. The horizontal cross-section is elliptical with an outside diameter of 13 ft. 10 in. on the long axis. Double "V" butt joints were used on the 1⅛" thick shell. 2" x 6" reinforcing bars were used in conjunction with a 1⅜" plate for the bottom construction. Total weight of completed ladle was 35 tons with a capacity for 150 tons of molten steel.

Let us give you complete information on these and other outstanding Ryerson electrodes. We will also be glad to send samples for test. Write for descriptive bulletin.

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has been completely equipped with power presses, shears, welding equipment, grinders and other tools.

---

When a 7-ton punch press at the Crunden-Martin Manufacturing Co., St. Louis, Mo., recently broke in two places, the job of repairing the huge machine fell to the Peerless Welding and Cutting Co., 3205 N. Broadway, St. Louis. According to Anthony Kalz, president of the Peerless company, the greater part of a day was expended in unloading the unwieldy punch press at his shop. Tobin bronze was employed in brazing. With the job completed, the press, which is approximately forty years old, was found to be only three-thousandths of an inch out of line—more true to its original measurements than it had been for a long time prior to breaking.

---

The Joy Manufacturing Co., Franklin, Pa., large builders of coal-loading machinery for the mining industry, have announced plans to increase their plant facilities. The company recently has been turning out an average of 40 coal-loading machines per month. Much of the work on the body of these machines is done by welding. The Joy organization recently received a large order for snow removal equipment, awarded them by the City of New York, necessitating an increase in their facilities. The plant has been operating two shifts per day for the past year and reflects the increasing trend toward mechanization in the coal-mining industry.

---

Reports are current in the boat and barge building yards of the Pittsburgh district that a huge brokerage firm has appropriated $5,000,000 for the construction of a fleet of steel barges and four steamboats. While the names of the interested parties were not disclosed, it was learned that negotiations are under way to move coal from the Kanawha fields for the Chicago market, for which use this fleet will be constructed. It was claimed that the barges will be 198 ft. long, 35 ft. wide, and 12 ft. deep instead of the usual 11 ft. Two of the steamers will be equipped with plants developing 2,000 hp., and two of smaller size.

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The job of repairing the pot of a linotype machine was recently put up to C. N. Sloan, proprietor of the Mechanical Welding Co., 1904 Delmar Blvd., St. Louis, Mo. Not being table to gain access to the pot from the top of the machine, owing to the limited space, he sawed out a segment of the machine at the base of the pot, and through this opening he made the repair on the 1-in.-thick cast-iron pot with a welding torch and rod, and at the end of two hours the piece cut out of the machine had been welded back in place—at a saving of $75 to the customer over the cost of a new pot.

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The General Welding Co., formerly at 2030 W. Fort St., Detroit, Mich., has purchased the building at 2134 20th St. and has added a new metal-storage building, giving a total of 10,000 sq. ft. of floor space. During the past year 22 welding units were added, making 54 pieces of equipment on hand for arc, gas, resistance and atomic-hydrogen welding. Though this concern has been in business since 1927, it only recently incorporated, with an authorized capital stock of $50,000, representing 15,000 shares.

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The engineering division of the Dravo Corp., of Pittsburgh, Pa., has completed the construction of a fleet of four specially designed all-welded coal barges for O. F. Shearer & Sons for service on the Kanawha River. These barges are each 100 ft. long, 26. ft. wide and 11 ft. deep. This same company also reports that final work is under way on a fleet of 7 all-welded coal barges for use by the Keystone Sand & Supply Co. and the Union Barge Line Corp., both of which are subsidiary companies.

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The Elco Welding Works, of Maywood, Calif., announce that they will soon erect a new shop building at the corner of Slauson Ave. and Downey Road. The new building will have a 150-ft. frontage and a depth of 50 ft., being on an odd-shaped lot 246x70 ft. E. L. White, owner, has been in the welding business in the vicinity since 1921. He will engage in truck repairing and accessories, as well as the manufacture of mining equipment and of an improved type of hammer mill.

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Ralph Sloughter, proprietor of the Owl Battery Service, 4617 Easton Ave., St. Louis, Mo., who during the spring began doing some welding as a sideline to his battery business, finds today that this branch has developed beyond expectations and is usurping more and more of his time, to the benefit of his pocket book. He is engaged principally in the welding of fenders, frames, motor blocks, and other automobile and truck parts. The battery business was established twelve years ago.

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Nick Dragich, a leader in the fishing industry off the coast of Southern and Lower California, is planning the early construction of a 167-ft. steel all-welded purse seiner, to cost approximately $200,000. The craft will carry 112,000 gallons of fuel, which is sufficient to cruise 16,000 miles—double that of any other similar craft now in use on the


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**Assured dependability, performance, economy** This explains why Torchweld torches consume 20 per cent less fuel gas than others, why no Torchweld torch has ever worn out from usage alone, and why Torchweld produces equipment meeting the U. S. Navy specifications protecting against flashbacks and backfires.

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Pacific coast. It will also bear the distinction of being the first all-welded steel vessel ever built for the local fishing industry.

---

The Nashville Bridge Co., of Nashville, Tenn., has received a contract for the construction of a fleet of five sand and gravel barges from the Pfaff & Smith Builders & Supply Co., of Charleston, W. Va. The carriers will be put in service on the Kanawha and Ohio Rivers. These barges, of the flush-deck type with cargo box, will be 100 ft. long, 26 ft. wide, and 6.6 ft. deep. Approximately 1,330 tons of steel plates and shapes will be required in the construction.

---

The welding of pin and box collars on oil-well drill pipe back of the point where the joints wear through is highly satisfactory, according to J. E. Rogers, welding foreman for the Anderson-Kerr Drilling Co., of Oklahoma City, Okla. A five or six dollar expert job of welding, building the collars back two inches at a time, cuts down the requirements for replacements of collars at $40 to $50 each, Rogers says.

---

The Ohio River Co., of Cincinnati, O., are constructing a mammoth coal barge on their own marine ways at Huntington, W. Va. This barge will be 195 ft. long, 35 ft. wide, 11 ft. deep, and of all-welded construction. W. W. Marting is general manager in charge of construction and A. C. Ingersoll is vice-president in charge of river transportation for the company.

---

An order has been given The Superior Welding Co., Peoria, Ill, for installing, by welding a 2½-in. galvanized pipe in each compartment of the tanks on the supply trucks of the Peoria branch of the Standard Oil Co. These pipes will act as air vents and safety devices for filling supply station tanks during the hot weather. On completion of the work, it will be necessary to reapacitate each compartment.

---

Three galvanized steel water-reserve tanks on the sub-chaser in Peoria, Ill., were recently removed by cutting them into sections 14 in. wide and 4 ft. long, with the oxygen cutting torch. This was necessary as they were taken out through the hatch. Two operators alternated in using the torch and necessary precautions were taken by using respirators and a fan for air circulation.

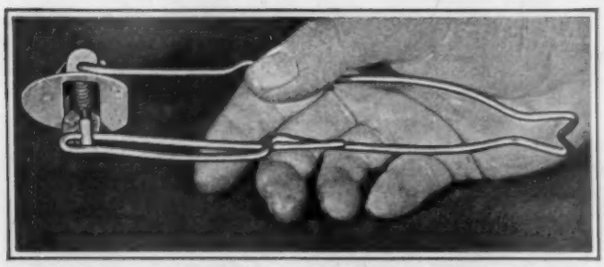
---

E. H. Carlton, of M. System Stores, has begun the manufacture of welded house trailers with all-steel frames and chassis. The factory is located at 1106 Hemphill St., Fort Worth, Texas. Initial plans call for completion of seven trailers per week. Fourteen men are on the payroll at present. Carlton trailers will be sold through authorized automobile distributors.

---

The Olympia Welding Works was recently organized, at 5955 W. Grand River Ave., Detroit, Mich. The owners are H. T. Decker and J. E. Decker. The shop is equipped with stationary and portable welding units, and will be prepared to handle general welding work. In addition, they are specializing in work for general building contractors. The Decker brothers formerly operated under the name of the Decker Co., and had a smaller shop at 3412 McGraw Ave.


# The Improved "Round File" Gas Lighter



Many superior design and construction features, found only in Improved "Round File," make this lighter the Welder's Favorite.

**Hood forms a pocket for gas,** insuring immediate ignition.
**Larger file area,** providing longer life for lighter.
**Larger spark metal,** which assures many additional ignitions.
**Locking slip-on renewal cartridge,** permits immediate replacement.
**Cadmium plated, preventing rust.**
**Every part thoroughly tested.**
**Fully guaranteed.**

*Write for descriptive circulars and prices.*

**CAUTION:** Imitations of the patented Improved "Round File" are on the market. For your protection insist on Safety Gas Lighter Co. patented lighters and genuine Safety Gas Lighter Co. renewals.

ORIGINATORS OF THE HAND GAS LIGHTERS **SAFETY GAS LIGHTER CO.** Est. 1901 **LYNN, MASS.**


The American Barge Line Co., of Pittsburgh, Pa., has placed an order with the Dravo Contracting Co., also of Pittsburgh, for the construction of seven huge gasoline barges, to take care of the increasing demand for the movement of petroleum products on the Ohio and Mississippi Rivers. These barges will each be 175 ft. long, 26 ft. wide and 11 ft. deep, and of all-welded construction. The same company is also purchasing three standard-size coal barges.

---

George E. Roper, assistant general manager of the River Terminals Corp., of New Orleans, La., has awarded a contract for the constructon of a large towboat for service on the lower Mississippi River. Considerable welding will be employed in the construction. The contract goes to the Nashville Bridge Co., Nashville, Tenn., and when completed the boat will be brought to Paducah, Ky., where the Fowler-Wolfe Co. will install a battery of boilers.

---

The second tank for the new refrigeration system of Armour & Co., in Peoria, Ill., is now completed. It is built of ¼-in. steel plate and is 6 ft. high, 7 ft. wide and 18 ft. long. It is of all-welded construction. Final pipe connections are now being made. This is a combination calcium and salt-brine tank, located in the engine room, and the pipe dimensions vary from 1 to 8 in. The work is being done when the plant is not in operation.

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Delivery of an all-welded coal barge with a capacity of 1,600 tons was made recently from the Wilmington shipyards of the Dravo Corp. for the account of M. & J. Tracy, Inc., New York City. The barge is 134 ft. long, 34 ft. wide and 16 ft. deep. It was fabricated at the Neville Island marine ways of the corporation and assembled at the Wilmington works.

---

The Wheeling Steel Corp., Wheeling, W. Va., are inquiring for 20 to 25 barges for use in transporting coal from their own mines to the various plants of the corporation. The company is also reported to be in the market for a new tow boat. The barges will be 140 ft. long, 26 ft. wide and 10 ft. deep, with a maximum capacity of 700 tons.

---

"The Trained Welder's Opportunity for Advancement" was the subject of a talk by H. O. T. Ridlon, of the Bastian-Blessing Co., on Dec. 11 before the Alumni Association of the Cleveland School of Welding at the Hotel Sterling in Cleveland. Mr. Ridlon also conducted a question-and-answer forum.

---

Inspectors of the U. S. Engineers offices in Pittsburgh, Pa., have been asked

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**CHAPTER I**
*The Welding Gases*
Introductory — Oxygen — Calcium Carbide —Acetylene — Acetylene Generators — Dissolved Acetylene.

**CHAPTER II**
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**CHAPTER IV**
*Methods of Welding*
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*Preparation for Welding*
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**CHAPTER IX**
*Testing*
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**CHAPTER X**
*Important Applications*
Tank Welding — Pipe Welding — Sheet Metal Welding — Aircraft Welding — —Brazing — Silver Soldering—Hard Facing—Cutting—Typical Jobs.

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to pass upon 230 ft. of 20-in. welded steel dredge pipe now being fabricated in the Leetsdale plant of the Bethlehem Steel Co. in Pittsburgh. This pipe is for the U. S. Engineers department at St. Louis and will be used in connection with work on the Mississippi River.

---

A. L. Smith, who recently resigned as vice-president and general manager of the West Virginia Armature Co., a firm which he founded a quarter of a century ago, has organized The Smith Welding & Equipment Co., Inc., Bluefield, W. Va. The authorized capital stock is $50,000. Definite plans for the future have not been announced by the new concern but for the present they will handle the account of the Southern Oxygen Co., of Washington, D. C., maintaining a wholesale distributing plant for the company.

---

The Dayton Welding Co., 420 W. Third St., Dayton, Ohio, has been doing a considerable amount of welding of broken parts of adding machines and cash registers brought to the Dayton branch office of the Burroughs Adding Machine Co. for repairs. By welding these various parts, the owners of the machines are saved many days of waiting for the new parts to come from the factories.

---

The Advance Body Works, of Los Angeles, Calif., manufacturers of all-welded auto bodies, truck tanks, etc., recently built a body for a new type of car. The new car is known as the "Tear-drop," the motor of which is mounted at the rear, and is front-wheel driven. Steering is by a single rear wheel. The wheel base is 125 in., and over-all length is 204 in. The turning radius is the car's length.

---

A new building with 5,000 sq. ft. of floor space was recently completed for the Weiler Welding Co., 318 E. Third St., Dayton, O. This new structure will house a considerable amount of equipment and steel plate stock. The company has been making machines, machine parts, tools, jigs and fixtures from steel plates for various firms in and around Dayton.

---

The New Ideal Welding Co., 344 S. Main St., Dayton, O., played a major part in the installation of a conveyor system in the $150,000 addition to the Inland Manufacturing Co. building on Abbey Ave. in Dayton. They constructed the conveyor system's steel framework, an all-welded job. Oxyacetylene welding will be used on all steam pipes installed in this building.

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H. J. Osterfield, 417 Main St., Dayton, O., recently did some welding on the heating plant being installed in the new addition to the Standard Register Co. building at Albany and Campbell Sts. Also, all connections on the new power plant and heating system installed at the Gum Products Co., Troy, O., were welded by Mr. Osterfield.

---

Arthur Knapp, who directs the welding business of Knapp & Son, 930 Massachusetts Ave., Indianapolis, Ind., reports that his business has about doubled in the past year. As a result, he says, he is contemplating additions in both personnel and equipment. Mr. Knapp states that his chief difficulty is finding experienced and capable welders.

---

Chas. Watkins, well known in welding circles in the industrial district of Los Angeles, recently organized the Alliance Welding & Manufacturing Corp., at 5819 Compton Ave., in Los Angeles. In connection with the management of the manufacturing concern, Mr. Watkins will also conduct a school of practical welding.

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Louisville, Ky., has two new welding shops, one the Falls City Machinery Co., 625 E. Main St., which opened a few weeks ago, and E. D. Smith, 633 E. Main St. Previous to opening his shop on Main Street, Mr. Smith had been in the welding business for two years.

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The Pittsburgh district office of the U. S. Army Engineers has been asked to supervise the construction and inspection of three all-welded dump scows being built by the Federal Government at the Ambridge, Pa., plant of the American Bridge Co.

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The Gay Engineering Co., welding contractors of Los Angeles, have been awarded a contract for the rebuilding of the Imperial Ice & Development Co.'s ice-manufacturing plant in El Centro, Calif. The plant was recently damaged by fire.

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All-steel welded bungalow courts are becoming common in southern California, according to Burt Sorenson, builder, of Inglewood. Mr. Sorenson has built a number of these steel courts, and permits were recently granted for two more.

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The Triangle Welding & Mfg. Co., Los Nietos, Calif., featuring general oilfield welding and gidding-bit service, recently opened a branch shop in Bakersfield, which is at present the center of considerable new drilling activity.

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C. F. Braun & Co., of Alhambra, Calif., well known in the welding industry in southern California, recently erected a large addition to the plant and added new welding equipment.

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The Greer College of Welding, 2024 S. Wabash Ave., Chicago, Ill., have added H. C. Hibbert to their instruction staff. The welding department now occupies the entire second floor of the school building, and new equipment has been added.

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Cole's Welding Works is the name of a welding job shop recently opened for business by Geo. A. Cole, at 3715 E. Florence Ave., in Bell, Calif. Mr. Cole has been associated with the welding industry in southern California for twelve years.

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A. J. LaRue of 330 Paramount Ave., Hynes, Calif., recently opened a new job welding shop, specializing in building and repairing heavy trucks and trailers. A new 200-ampere arc welder forms a part of the shop's equipment.

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Glick Brothers Lumber Co., 7412 Cottage, Huntington Park, Calif., has installed a 300-ampere arc welder in its repair shop for use in repairing its trucks and other equipment. M. G. Smithson is in charge of the welding.

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Welded steel silos, bins and structures are soon to be erected by the Metropolitan Water District, of Los Angeles, Calif., for the aggregate plant at the east portal of the San Jacinto tunnel, seven miles east of Banning.

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J. M. Pool, owner of the Louisville Welding Works, 807 S. First St., Louisville, Ky., reports business is so good that he has now taken on several welding students who are working in his shop.

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The Union Welding & Boiler Works, 4224 Spring Grove Ave., Cincinnati, O., now operates a completely equipped machine shop in conjunction with its welding business.

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The Cleaners Equipment Corp., 7500 East 10th St., Kansas City, Mo., manufacturers of cleaners' equipment, are now engaged in the manufacture of oilfield tanks.

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G. Y. Bentey has opened a welding shop at Mammoth Springs, Ark. The new shop is equipped to handle automobile and any type of commercial welding.

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J. T. Wortham recently opened the Wortham Welding Works at Pine Bluff, Ark. The new concern is prepared to do practically any type of welding.

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What is said to be the first welded locomotive boiler ever built in this country is nearing completion by an Eastern firm.

The Pittsburgh, Pa., office of the American Bridge Co. reports the completion of 14 standard all-welded steel coal barges out of an order of 25 recently received from the Carnegie-Illinois Steel Corp. These barges are being used on the Monongahela River. Both companies are subsidiaries of the United States Steel Corp.

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The Geo. C. Christopher & Son Iron Works, Wichita, Kan., are nearing completion of a large steel handrail job which they have had in their shop for some time. They contracted to furnish 5,000 lineal feet of all-welded handrail for the new Kansas State Highway bridge across the Republican River near Manhattan.

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The Kaw Point Boat & Motor Co., Kansas City, Mo., has been awarded a contract from the Socony Vacuum Oil Co., of New York City, for the construction of a fleet of four all-welded tank barges for service on the Mississippi, Ohio and Missouri Rivers. The barges will have a capacity of 8,000 barrels each.

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The Starr & Boyce Machine Works is the name of a new welding and machine shop in Osceola, Ark. Mr. Starr has operated a shop in Osceola for the past several years, and Mr. Boyce, prior to the formation of the new partnership, was in charge of the welding shop of Lee Wilson & Company at Wilson, Ark.

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There seems to be no limit to the antiquity of some automobile engines. V. E. Peterson, a job-welding-shop operator of Moline, O., recently had to weld a Reo engine block that had frozen and cracked. Much to his surprise, he found that it was of the vintage of 1904.

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Roy McGee, a former welding-shop owner, has purchased half of the business of the Anderson Bros. Trucking Co. and formed a pipeline construction company at Seminole, Okla., under the name of Anderson & McGee.

The General Machine & Tool Co., of Wichita, Kansas, are now fabricating welded oil-well pump jacks at their Augusta, Kan., plant. Oilfield machine shops and supply stores are also maintained at Russell, McPherson and Haven, Kan.

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The Mid-Continent Pipe & Supply Co., Oklahoma City, Okla., have opened a branch shop at Lyons, Kan. Their shop work consists mainly of reconditioning pipe and welding.

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The A. A. Doerr Merc. Co., Larned, Kan., have opened a tank shop in connection with their other business. Small welded farm tanks will be their specialty.

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The Glick Brothers Lumber Co., of Huntington Park, Calif., is adding electric-welding equipment to its new repair department at 8420 S. Alameda Blvd.

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A 12-in. welded steel water main was recently installed by the city of Inglewood, Calif.

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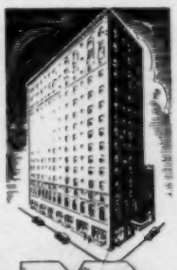

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